TTY Forum

TTY FORUM - 19

Meeting Summary Report

September 26, 2001
ATIS Conference Center
Washington, DC

Table of Contents

TTY/TDD Forum – 19

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ATIS Conference Center
1200 G Street, NW, Suite 500
Washington, DC

TTY Forum

Agenda

Chaired by Ed Hall, ATIS

1. Call to Order, Introductions and Attendance Roster

2. Call for and Number of Contributions

3. Review & Approve Agenda

4. TTY Forum #18 Summary

5. Correspondence

6. TTY Liaison Reports: *FCC; CTIA; NAD; TDI*

7. Review TTY Forum #18 Agreements and Action Items

8. Industry Implementation Status Reports

9. Technical Activities
    a. TTSI Report
        i.   TDMA
        ii.   CDMA
        iii.   GSM
    b. Scoring
    c. TTY Devices

10. Terminal product labeling for TTY accessible devices

11. Next Meeting: December 11, 2001

12. New Business

13. Adjournment
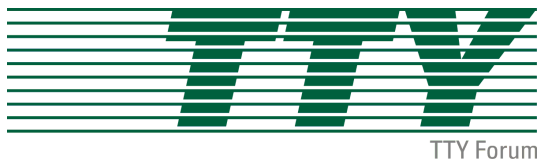
TTY/TDD Forum – 19

September 26, 2001
ATIS Conference Center
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Washington, DC

Meeting Summary

1. Call to Order, Introductions and Attendance Roster

Ed Hall, ATIS, Chair, called the meeting to order at 9:03am. He stated that there are quite a few members attending this meeting via the Conference/virtual link. He asked Megan Hayes, TTY Forum Secretariat, to make a few comments on accessibility. She explained that having a Virtual Meeting in addition to the face-to-face meeting presented serious challenges to accessibility and outlined some suggestions for all participants to make the meeting as accessible as possible. All participants took the opportunity to introduce themselves.

2. Call for and Numbering of Contributions

Ed Hall introduced all contributions, and asked for any additional contributions. There were none. All contributions provided to the Secretariat electronically are available for download on the TTY Forum web site at http://www.atis.org/atis/tty/documents, or by sending a request to Megan Hayes (mhayes@atis.org). Contributions were submitted and numbered as follows:

Number	Title
TTY19/01.09.26.01	Agenda
TTY19/01.09.26.02	Roster
TTY19/01.09.26.03	TTY18 Meeting Summary
TTY19/01.09.26.04	TTY18 Agreements and Action Items
TTY19/01.09.26.05	TTSI Report to TTY Forum – 19
TTY19/01.09.26.06	Digit Wireless Presentation
TTY19/01.09.26.07	Sprint PCS Report
TTY19/01.09.26.08	Ericsson Report
TTY19/01.09.26.09	Appendix B – Recommended Text, Consumer Notification
TTY19/01.09.26.10	Agreements & Action Items
TTY19/01.09.26.11	TTY19 Meeting Summary
TTY19/01.09.26.12	

3. Review & Approve Agenda

The agenda was distributed and approved without modification.

4. TTY Forum #18 Summary

Ed Hall asked if there were any suggested modifications to the TTY Forum #18 Meeting Summary. There were none and the document was accepted as final.

5. Correspondence

There has been no correspondence received since the last meeting.

6. TTY Liaison Reports: FCC; CTIA; NAD; TDI

- FCC—Mindy Litell thanked all entities that filed reports last quarter. She noted that the reports are a valuable source of information for the Commission and expressed her appreciation for the Forum's effort in compiling these reports. She stated her hope that all necessary equipment is available so that carriers can meet the 12/31/01 deadline. She reminded the participants that reports will continue to be required each quarter and the FCC looks forward to hearing about any further issues and concerns.

- CTIA, NAD, and TDI had no reports at this time.

7. Review TTY Forum #18 Agreements and Action Items

Ed Hall reviewed all agreements and action items from the TTY Forum #18. There were no further comments submitted on these items at this point.

8. Industry implementation Status Reports

Ed Hall noted that there were 2 written reports submitted for this meeting, and after their presentations verbal reports would be accepted. He noted that the verbal reports should be followed by a written submission to the TTY Forum Secretariat by October 10, 2001, 5pm, Eastern Time. Reports should be emailed to Megan Hayes (mhayes@atis.org).

SPRINT PCS
Rachelle Redfairn and Scott Freiermuth introduced contribution TTY/01.09.26.07. They reported that Sprint PCS began testing in its internal lab, and that testing of vendors is to proceed over the next few months. They reported that they are having some difficulty with interoperability tests, and they have not isolated the problem at this time. They will be testing to determine problems, using the Gallaudet software. Andrea Williams, CTIA, asked where they were seeing these problems, in the handsets or in the network. Scott Freiermuth responded that they do not have the answer to that question at this time, but they will be isolating the elements in testing to trace the difficulty. Ed Hall mentioned that Sprint PCS has been very active with the TTY Technical Standards Incubator (TTSI), and will figure prominently in the TTSI report.

Ericsson
Matt Kaltenbach introduced contribution number TTY/01.09.26.08. He reported that the TDMA network testing is complete and release is expected October 31, 2001. FOA testing is scheduled for November. He reported that the feasibility for carrying TTY has been proven across the board. GSM initial testing products have been constructed and released for testing. CDMA network code is currently under development, no test results are available at this time. Some participants noted their concerns with problems previously reported with TDMA systems. Mr. Hall reported that a lot of work had been done on TDMA, and more information on the progression of that work will be provided in the TTSI report.
Matt Kaltenbach also reported that TDMA handsets are behind schedule and have encountered problems in the development integration process with system elements. Tests are currently being run to solve these problems. GSM handsets are slightly behind schedule due to standards activity that was not completed until July 21, 2001. These changes have had a minimal impact on the overall GSM development schedule. CDMA handsets are slightly behind schedule and have encountered problems with the development integration process with TTY devices. Testing is being carried out to isolate and solve these issues.

He reported that development testing is complete or nearly complete and product testing on Infrastructure is in process. Testing done in early September yielded favorable results. Handsets will be available to carriers over the next 2-3 months.
Mr. Kaltenbach reported on Ericsson's support of the ATIS incubator initiative for TTY testing. This initiative has helped to solve several problems, and was absolutely invaluable for validating where the product was in the development process.

Beth Wilson, SHHH, asked about tests being developed in Voice Carry Over (VCO). Mr. Kaltenbach answered that they were dealing with secondary issues with VCO and that no detailed VCO testing has occurred yet. Gary Pelligrino, CommFlow Resources, asked about Short Message Service (SMS) signal issues. Matt replied that they have identified SMS as a test case that will need to be run, as SMS does cause an interrupt and it is a known interference. Norman Williams, Gallaudet University asked about the length of the interrupt from SMS Messaging. Matt referred that question to a carrier with more knowledge. Scott Prather, AT&T Wireless, responded that the interruption is device dependent. It depends on how the alert is set and, to his knowledge, most handsets can now disable the alert to cause only a 1 or 2 character loss. Mr. Prather also reported that you can receive the SMS message without the alert. Ed Hall stated that the incoming SMS does not interfere with the TTY message, it is the manner in which the device handles the message when it is received. He suggested the following action item.

ACTION ITEM: (19.1) The TTY Forum Chair will communicate to the TTSI Incubator Group that there should be a white paper written identifying the problem with SMS messaging tones with TTY. The white paper should also address any other features that use auditory alerts and may cause higher character error rates.

A suggestion was made by Mr. Williams that a third solution to the character loss with SMS would be the ability to turn off SMS while on a phone call. It was recommended that the three states of SMS were: (1) turning off SMS permanently, (2) having SMS disabled during a TTY call, and (3) having no alert tone sound during a TTY call.

Lee Whritenour, Verizon Wireless, reported that many handsets might already be meeting these needs with various methods. He suggested that other features with alerts might also need to be addressed.

Gallaudet University
Jim Huntley, Gallaudet University, reported that Gallaudet assisted with the TTSI testing, which was held September 11-14, 2001 in Lisle, Illinois. The Gallaudet scoring program was used, using both the fast and slow typist tests. Analog and TDMA tests were run and in all but analog there was an average result of an under 1% error rate. He reported that TDMA technology performed as well or better than analog. A participant asked about the recommendations from Gallaudet, and how they compare with the results. Judy Harkins, Gallaudet University, replied that the recommendations were based on the FCC requirements, and they are around the 1% character error rate. Al Sonnenstrahl, CAN, asked about the effects of high-traffic during testing on September 11, 2001. Jim Huntley replied that the high traffic did change the way the tests were run, focusing the testing on local calls where the network was less congested. He reported that internal testing has been done on long-distance calls.

Cingular
Ken Evens, Cingular, reported that Cingular is very pleased with their testing results.   Handset test results are showing acceptable error rates. No testing has been done on the GSM side, and no equipment is expected until mid-November. Testing for GSM will begin in December. He reported that the progress to date has been good.

Concerns were expressed that tests be run during high-traffic times so that the error rate during a TTY call can be shown to be similar to the error rate on voice calls. Norman Williams, Gallaudet University, noted his concerns about being able to use the phone, and maintain a connection during an emergency when cell phone traffic is very high. Andrea Williams, CTIA, noted that all mobile subscribers, regardless of whether they were using TTY machines, would experience the same network congestion during high traffic times.

ACTION ITEM: (19.2) The TTSI Incubator Group should plan to include testing during high-traffic hours.

AT&T Wireless
Lori Buerger, AT&T Wireless, reported that AT&T has completed a lot of work since the last TTY Forum meeting. She introduced Scott Prather, AT&T Wireless, who reported on the Lucent Infrastructure testing occurring in their lab. Specifically, he reported that an FOA was performed in the Chicago area to test the Lucent Software IS823 Algorithm in the field. The test was performed under a variety of conditions and the results of these tests were favorable. Following the FOA, a hearing-impaired employee had been using different phones and reporting back with any problems or errors. Testing results with the Nortel Software provided the same favorable results as the Lucent tests. He reported that hand-offs were also tested and those results were favorable as well. AT&T hosted the ATIS incubator testing in September, and tests on the Lucent platform continued. Scott gave his thanks to everyone who helped out with the ATIS incubator tests, and he thanked all those who participated.

Nokia
Chris Wallace, Nokia, reported that Nokia is in the process of generating their final reports. He reported that TDMA is the most advanced in terms of testing and that GSM has presented the most challenges. He reported that testing with Nortel should begin in October. No devices are available to the market at this time, but the schedule is on track, and they are confident that they will meet the FCC deadline.

Nextel
Bob Montgomery, Nextel, reported that they are in lab testing with Motorola handsets and infrastructure, and in October they will be field testing. He had no results to share at this time, but noted that Nextel plans to meet the FCC deadline.

Beth Wilson, SHHH, applauded the work that has been done and all the effort that has been put into this subject. She expressed concern about the meeting of all consumer requirements. She plans to report to her membership that a lot of progress has been made, and that all companies were planning to meet the deadline. She expressed her concern about all the action occurring in December. Ed Hall, ATIS, clarified that the deadline for availability to consumers was June 30, 2002. Andrea Williams, CTIA, reiterated the importance of setting realistic deadlines and expressed concern about the aggressive deadlines.

Beth Wilson, SHHH, also expressed her concern over the lack of VCO/HCO testing. Al Sonnenstrahl, CAN, wanted to remind the industry that the market for VCO users was much wider than it initially appears. David Nelson, NAD, added to Beth's comments that he feels that testing needs to be expanded to deaf, hard-of-hearing and TTY users.

9. Technical Activities

a. **TTSI Report**—Ed Hall reported that TTSI has taken some issues from TTY off-line to help ensure that the manufacturers meet the deadlines. He reported that one of their deliverables is White Papers. The TTSI was created to allow for work to be expedited and coordinated testing to be completed. Jim Turner, ATIS Internetwork Interoperability Test Coordination Committee (IITC) Technical Coordinator, helped to coordinate the testing for TTSI. Mr. Turner reported that the testing in September went well and there is a methodology in place to protect vendor's information, yet still allow for the free flow of information to progress the work. Judy Harkins, Gallaudet University, asked which script was used in the TTSI Testing. Jim reported that the Gallaudet University scripts were used. When the tests are complete the test report will be made public. He noted the following schedule for testing:

i. TDMA testing was held in Lisle, IL in September, various infrastructure and handset manufacturers ran a variety of tests with favorable results and the identification of some problems. Special thanks to AT&T Wireless, Scott Prather, Lori Buerger, and NENA, Toni Dunn.

ii. CDMA tests are being scheduled.

       iii.   GSM tests are also being scheduled.

    b.   **Scoring**—Ed Hall stated that this would be discussed further during the TTSI meeting tomorrow. Matt Kaltenbach reported that Gallaudet provided a very useful tool covering many levels and provided TTSI with an automatic scoring software program. He noted that the TTSI testing also used the Lober & Walsh testing which is good for developmental testing for one-directional conversations. It also has a score for time delays between characters. The two tools are inherently different but combined they are extremely useful in both the field-testing and the developmental arenas. Mr. Hall asked about any problems encountered in the scoring. Mr. Kaltenbach replied that there have been some errors in the Gallaudet testing that will be addressed at the TTSI meeting. He reported that some of these errors could be removed to improve the use of this testing program. Scott Prather expressed his concern that scores could be different between Gallaudet and Lober & Walsh. Judy Harkins stated that the Gallaudet software uses Lober & Walsh scoring, however, it scores each direction separately. Judy Harkins noted that Norman Williams will be leaving Gallaudet on Monday, October 1, 2001, and the industry will need to contract with him separately for further software developments. Ken Evens, Cingular Wireless, gave his support to using the Gallaudet Software for the FOA testing. Sprint PCS also supported the use of Gallaudet testing

AGREEMENT REACHED: (19.3) TTY Forum participants agreed to use Gallaudet University's testing script version 1 (1.1) for all FOA type testing, and to continue to use Lober and Walsh for all lab testing.

    c.   **TTY Devices**
         Dr. David Levy, CEO and Founder of Digit Wireless, introduced Contribution TTY/01.09.26.06, a presentation on Digit Wireless' FastTap technology. FastTap is a user interface designed to replace "triple tapping" for SMS and other text input devices. Lee Whritenour recommended using the benefits of this product to push this product forward. David Levy informed the group that he would be working on more tactical feedback through this keyboard. Al Lucas, Motorola, stressed that FCC's Section 255 is the way to indicate the accessibility issues related to E911 to the manufacturers. Dr. Levy asked about the plausibility of the use of Fast Tap for a 9-1-1 call. Judy Harkins stressed that it could be used only with the co-operation among several industries, including the TTY manufacturers. Dr. Levy reported that he would like the Fast Tap to become an integrated TTY unit in mobile phones.

USER REQUIREMENTS
Before getting into Terminal Product Labeling, Ed Hall re-introduced Appendix E of the TTY Forum Meeting Summary, which lists user requirements and the industry's response. Mr. Hall noted that it was important to review Appendix E at this time because of the questions posed earlier regarding error rates for static and mobile testing. Mr. Hall reviewed the list of consumer questions – TTY User Intervention (Contribution TTY/01.06.12.16). In regards to #13,

regarding eyes busy environments, there was discussion regarding the meaning of this point, and how it is important to the consumer.

ACTION ITEM: (19.4) The consumer community will review line item #13 in the TTY User Intervention Document (Appendix E) regarding "Is it usable in an "eyes busy" environment" and re-state it, if needed, to clarify confusion.

Appendix E was edited and revised, and the TTY User Intervention Questions were added. To view the revisions, please see Appendix E of the TTY Forum #19 Meeting Summary.

ACTION ITEM: (19.5) Line Item #7 of the TTY User Intervention Document (Appendix E) will be reviewed and edited off-line by Gallaudet to cover the interference of TTY with other phone features, including dialing.

ECHO
Mr. Hall noted that he wanted to address the echo control issue. He reported that a lot of discoveries have been made in TTSI. Matt Kaltenbach reported that some of these problems are related to the distance of the caller from the PSAP. Testing will have to continue on calls that are a great distance from the PSAP.

VOICEMAIL/TTY MAIL
Mr. Hall noted that he also wanted to continue the discussion of VoiceMail/TTY Mail that had begun at the TTY Forum #18 meeting. He referenced Contribution TTY/01.09.26.04, which is the Agreements and Action Items from the TTY Forum #18 meeting. Mr. Hall suggested that the TTY Forum draft a list of concerns regarding Voicemail for TTY users to be sent to the IVR Forum as a liaison. The issues identified include control of the voice-mail system, control over the number of rings before a call is forwarded to voice mail, and that the DTMF should still work if they have the audio cable plugged in. Beth Wilson also added the reminder that those using the TTY Systems are not necessarily deaf users.

Judy Harkins also added her questions to this issue: Does the system have the ability to accept TTY control? Will it record and playback TTY? Is the system set-up to go automatically to voice-mail? Can you take off the voice-mail system and route it elsewhere?

These questions were added as an action item in the document to the IVR Forum stating, "The IVR Forum should attempt to determine carrier capabilities when TTY over digital becomes available."

ACTION ITEM: (19.6) The Voice Mail Recommendations will be passed on to the IVR Forum for their review, via a liaison from the TTY Forum.

AGREEMENT REACHED: (19.7) The revised Appendix E of the TTY Forum Meeting Summary was approved as revised.

10. Terminal Product Labeling for TTY Accessible Devices

Ed Hall noted that this agenda topic was not discussed at the TTY Forum #18 meeting because of time constraints. Consumers would like labeling on all TTY compatible digital wireless phones to allow for easier purchase. The Chair recommended that the TTY Forum should not move forward with a specific labeling requirement, but should agree that TTY compatible phones should be labeled in such a way that their compatibility was obvious to the consumer. Lee Whritenour, Verizon Wireless, noted that CTIA created a labeling symbol to indicate that a phone was equipped with authentication technology and suggested that CTIA might be able to create a similar label for TTY compatibility. The Chair noted that he is hearing support that there should be some type of labeling. The Chair recommended the formation of a working group to address drafting Guidelines for the industry

AGREEMENT REACHED/ACTION ITEM: (19.8) There will be a TTY Forum Working Group to address drafting guidelines for the industry on labeling equipment to indicate that it is TTY Compatible (members will include: Beth Wilson, Chair, Al Lucas, Matt Kaltenbach, Chris Wallace, Ken Evens, Jim House, David Nelson, Linda Day, Ron Schultz and Al Sonnenstrahl).

11. Next Meeting—December 11, 2001

12. New Business

Susan Palmer requested having the distribution plan for handsets put on the agenda of the next meeting. The Chair said that this would only be possible if the manufacturers are prepared to present that information. The Chair asked manufacturers to present this information, if possible.

13. Adjournment
Ed Hall adjourned the meeting at 3:50pm.

Respectfully Submitted by Megan Hayes, TTY Forum Secretariat.

TTY Forum #19
Meeting Roster
September 26, 2001
Washington, DC

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The following companies submitted their TTY Implementation Status Reports for the second quarter of 2001 through the TTY Forum, but did not attend TTY Forum #18.

Bluegrass Cellular, Inc.
Caprock Cellular Limited Partnership
Carolina West Wireless
Cellular Properties
Corr Wireless Communications LLC
Dobson Cellular Systems
Farmers Cellular Telephone Inc.
Midwest Wireless Holdings
Pine Belt Cellular
PYXIS Communications
Qwest Wireless LLC
Rural Cellular Corporation
Southern LINC
TMP Corporation

APPENDIX A

<u>AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM – 19</u>

19.1 The TTY Forum Chair will communicate to the TTSI Incubator Group that there should be a white paper written identifying the problem with SMS messaging tones with TTY. The white paper should also address any other features that use auditory alerts and may cause higher character error rates.

19.2 The TTSI Incubator Group should plan to include testing during high-traffic hours.

19.3 TTY Forum participants agreed to use Gallaudet University's testing script version 1 (1.1) for all FOA type testing, and to continue to use Lober and Walsh for all lab testing.

19.4 The consumer community will review line item #13 in the TTY User Intervention Document (Appendix E) regarding "Is it usable in an "eyes busy" environment" and re-state it, if needed, to clarify confusion.

19.5 Line Item #7 of the TTY User Intervention Document (Appendix E) will be reviewed and edited off-line by Gallaudet to cover the interference of TTY with other phone features, including dialing.

19.6 The Voice Mail Recommendations will be passed on to the IVR Forum for their review, via a liaison from the TTY Forum.

19.7 The revised Appendix E of the TTY Forum Meeting Summary was approved as revised.

19.8 There will be a TTY Forum Working Group to address drafting guidelines for the industry on labeling equipment to indicate that it is TTY Compatible (members will include: Beth Wilson, Chair, Al Lucas, Matt Kaltenbach, Chris Wallace, Ken Evens, Jim House, David Nelson, Linda Day, Ron Schultz and Al Sonnenstrahl).

<u>AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM – 18</u>

18.1 Contribution TTY18/01.06.12.13, "Testing Against User Requirements" will be added to Appendix D: TTY Test Completion Matrix of the TTY Forum Meeting Summary.

18.2 The Secretariat will add contribution TTY18/01.06.12.13, "Testing Against User Requirements" to Appendix D: TTY Test Completion Matrix of the TTY Forum Meeting Summary.

18.3 Judy Harkins will provide the URL for the web site describing the testing tools technology to the TTY Secretariat to make the information more readily available to TTY Forum participants.

18.4 The list of questions regarding user intervention (Contribution TTY18/01.16.12.15), will be considered for further discussion of user intervention.

18.5 The product labeling issue will be deferred until the next TTY meeting due to time constraints.

18.6 Regarding Features and Functions:
    CALL WAITING (CW)
- CW interferes with TTY communications.
- CW as a feature is disruptive and often not used by TTY users. Disabling CW by default for phones in TTY mode is an acceptable solution to the consumer community.

- CW can be disabled in a GSM environment (either permanently or via the handset menu).
- CW cannot be disabled via the handset menu in a TDMA environment; it has to be disabled at the switch.

VOICEMAIL/TTY MAIL (VM)

- Some systems do not record and play back to TTY machines as well as others.
- VM should be placed on the next TTY Forum agenda and referred to the AVSS/IVR Forum.

SHORT MESSAGING SERVICE (SMS)

- SMS signals may cause interruption in TTY communications.
- SMS is a desired feature for the consumer community.
- Queuing of SMS messages during a TTY conversation is not supported in some networks.

18.7 Elizabeth Lyle will submit a written proposal for a consolidated report for submission to the FCC. This report will be posted to the TTY Forum web site.

18.8 The next meeting of the TTY Forum (#19) will be held September 26 at the ATIS Conference Center in Washington, DC.

18.9 TTY Forum #20 will be held December 11 at the ATIS Conference Center in Washington, DC.

AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM - 17

17.1 The TTY Forum recognized ATIS as its Secretariat and official sponsor.

17.2 Ericsson, Lucent, and Nokia will look into the voice quality issue in terms of IS 127-2 CDMA and TDMA and report back to the TTY Forum whether or not there is a problem.

17.3 Consumer groups will review the "user intervention" handset function and report back at the next TTY Forum on whether or not the function is considered a viable option.

17.4 It was agreed to disband the E-Protocol Working Group.

17.5 It was agreed that the TTY Forum would file an ex parte to the FCC to report the solution proposed by the E-Protocol Working Group and the action taken by the TTY Forum.

AGREEMENTS FROM TTY FORUM — 16

16.1 TTY Secretariat, Megan Hayes, will add a non-attending participants list of those who submit implementation status reports to the chair but were unable to attend the TTY Forum

16.2 The industry implementation status reports will be added as an appendix to the meeting summary (Appendix L). All written reports will be sent to the chair within ten working days following the forum. This agreement will be sent out the list serve to ensure that all TTY participants (past and present) are aware of the agreement. The final Meeting Summary will be submitted to the FCC and will become public record.

16.3 TTY Forum industry members find that it is not within the scope and purview to address the e-protocol issue at this time. However, the chair will pass the concept and recommendation to SDO's (e.g. T1P1, TR45)

16.4 A working group will be created to explore the e-protocol issue. There will be an effort to ensure that all industry sectors are represented.

AGREEMENTS FROM TTY FORUM – 15

15.1 Toni Dunne, NENA, will be the principle point of contact for coordinating with PSAPs at a point in carriers, infrastructure, and mobile handset vendors field testing.
15.2 The TTY Forum will hold its next meeting on October 24, 2000 (second choice is October 25, 2000) at Gallaudet University. Meetings thereafter will be held on an "as needed" basis. The summary of the report from the October 2000 meeting will be formally forwarded to the FCC with a cover letter written by the Co-Chairs. Furthermore, on a voluntary effort, carrier will post a status update on their Website and/or the TTY list serve on 3/01, 9/01, and 3/02.

AGREEMENTS FROM TTY FORUM – 14

14.1 Establish Appendix J which will be a "living" document of technical terms and organizations and Appendix J, also a "living" document of technical standards development essential to the TTY Forum's Scope.

AGREEMENTS FROM TTY FORUM – 13

13.1 Lucent announced they will distribute the TTY vocoder solution, royalty-free, to mftrs implementing the solution. Lucent noted that it is not relinquishing the patent rights, just making the solution available royalty-free.

AGREEMENTS FROM TTY FORUM – 9

9.1 The TTY Forum agrees to submit User Requirements to TR45 in December, 1998.
9.2 Appendix G will be created as a living document to identify membership of the TTY Forum Test Procedure Study Group that will meet to track test plan modifications, facilities, and dates, user expert, point of contact.
9.3 Appendix H will be created to identify the operational characteristics of TTY devices.
9.4 The TTY Forum will develop a list of TTYs that fall within the domain of reasonable operational characteristics to provide an informational guide for carriers. The list will be available to the public via web sites and mailings.
9.5 The TTY Forum agrees that IWF is broadly defined as a translation method to complete a call that is transparent to the user. The IWF is not limited to either voice or data. An IWF may not be confined to a single network but may be shared across multiple networks.
9.6 The TTY Forum agrees to submit the SRD for the 2.5 mm Jack to TR45 in December, 1998.
9.7 The TTY Forum agrees to submit the SRD for Circuit Switched Data to TR45 in December, 1998

AGREEMENTS FROM TTY FORUM – 8

8.1 The TTY Forum agrees that all testing will be done in test labs simulating field conditions.
8.2 The TTY Forum agrees that the short-term solution will now be referred to as voice-based solutions. The long-term solution is now referred to as data based solutions.
8.3 An experienced TTY user will be available at the beginning of lab testing to provide counsel or training, if necessary.

AGREEMENTS FROM TTY FORUM – 7

7.1 The TTY Forum should remain operational until solutions are provided and implemented for all digital technologies, to the satisfaction of the TTY Forum.
7.2 The baseline for the digital solution is wireless analog performance.
7.3 Accept Contribution #12 as a working document to represent the basis of the test plan. Test Plan as modified by the technology groups (CDG,UWCC,GSMNA) will be sent to all phone manufacturers. Test plan will measure the performance of various digital air interface technologies.
7.4 Where possible, VCO/HCO should be included in the testing, design, and availability of TTYs, cellular phones, and air interface technologies.
7.5 The TTY Forum will submit a request for a three month extension to the FCC.

AGREEMENTS REACHED AT TTY FORUM - 6

6.1 Any carrier not in compliance with the Consumer Notification Process established at TTY Forum should be brought to the attention of the TTY Forum for resolution.
6.2 Working Group #1 is officially dissolved having completed its initial charter. Any further testing results would be forwarded directly to the TTY Forum.
6.3 A lack of TTY technical standard has resulted in a variance of TTY performance levels manifested when used on digital networks. As such, in developing the "short-term" digital solution, certain least used models of TTY may not be supportable on all digital air interfaces.

AGREEMENTS REACHED AT TTY FORUM - 5

5.1 As an initial step, carriers who can offer TTY users at least one digital phone model for each digital technology that a carrier offers at a reasonable price by October 1, 1998 would be considered in compliance of the E9-1-1/TTY compatibility requirements.
5.2 The FCC can use the information contained in the notification letter in any way they feel would expedite getting the information to the consumer.
5.3 All test results submitted will be included in the next Quarterly Status Report.

AGREEMENTS REACHED AT TTY FORUM - 4

4.1 Objective test (Throughput Test) approved and to be sent to manufacturers and carriers with a matrix to record testing completion dates and documentation.
4.2 TTY Forum Test Completion Matrix approved.
4.3 Consensus reached that Testing Matrix should go to every manufacturer listed at CTIA as well as Wireless and Wireline Carriers. CTIA/PCIA will escalate/elevate TTY Forum efforts to reach wireless equipment manufacturers and inform of urgency and criticality of rapid

response to the Testing Matrix via a letter from the TTY Forum and CTIA/PCIA. The group recognizes that participation is voluntary. Copies of letter and matrix responses will be sent to the FCC.

4.4 RFI will be put on issues list to explore possibility of interference between phone and TTY device.

4.5 Consensus to put TTY Forum's current research opinion on output voltages (coupling information) into a formal document and present to manufacturers for feedback. Give 30 days for feedback.

4.6 Subjective test (End User Test) to be finalized by committee. Testing will be handled through Gallaudet with assistance from Wireless manufacturers and TTY manufacturers. Will replicate authentic 9-1-1 calls with a deaf/hearing impaired caller and a trained calltaker.

4.7 CTIA will produce a list of Analog Phones that are compatible with TTY devices to be included in notification efforts and on web sites due as a Contribution at the next TTY Forum.

4.8 Gallaudet University and Consumer groups will draft a Consumer Requirements Document due as a Contribution at the next TTY Forum.

4.9 CTIA/PCIA will send letter to wireless equipment manufacturers requesting that they support Gallaudet University in their testing efforts by sending equipment.

4.10 Standards Requirements Documents (SRD) due for V.18 and the 2.5 mm jack as Contributions at next TTY Forum.

AGREEMENTS REACHED AT TTY FORUM - 3

3.1 6 sponsored spots for identified consumer groups, relinquished if member misses 2 consecutive meetings.

3.2 Accept modified "readability test" to be used by phone manufacturers to benchmark TTY over digital capabilities, to determine success rate for transport. (See Contribution TTY/98.02.11.06) Two tests: Manufacturers Readability Test, End User Test

3.3 Error rate is defined as "character" not "bit" for the purpose of this forum. (Shift error rate of ratio 1/8 (i.e. 1 shift error causes up to eight text errors and will be counted as such) to be determined)

3.4 Develop User Requirements Document. The outcome of Working Group #2. Represents the effort to provide for future advancements in technology by looking at solutions beyond 45.45 baud, Baudot.

3.5 Define process to update Notification Document: refer updated information to CTIA to be distributed to T-CAT.

AGREEMENTS REACHED AT TTY FORUM - 2

2.1 Combine Working Group #1 and Working Group #3. Develop new set of deliverables based on the October 1, 1998 deadline.
- Short term solution: solve for backward compatibility.
- Develop Standard Test to measure error rate of TTY over digital.

AGREEMENTS REACHED AT TTY FORUM - 1

1.1 "Solve for 45.45 Baudot, not to preclude looking for other solutions."
- Look for long term and near term solutions.

- - Near term - send through vocoder
    - Long term - circumvent vocoder, enhance quality and connectivity
- Provide for the analog function of wireless phones.
- The only body that can change the agreements reached is this body. All agreements remain intact until/unless action is taken in this forum.

APPENDIX B

Recommended Text
Consumer Notification

ATTENTION TTY USERS

Background

A TTY (also known as a TDD or Text Telephone) is a telecommunications device that allows people who are deaf, hard of hearing, or have speech or language disabilities to communicate by telephone. A TTY has a keyboard used to type a conversation, which then is transmitted as tones over a wired telephone line. The tones are translated to text that appears on a person's TTY screen.

911 and TTY Access Through Wireless Services

Federal law requires the telecommunications industry to provide a way for TTYs to communicate through wireless systems to make 911 calls. There are two types of wireless phones – analog and digital.

Analog – It is possible today to use some analog wireless phones reliably to call 911 with a TTY.

Digital – It is not possible today to use a digital wireless phone reliably to call 911 with a TTY.

Research is being done to improve the ability of digital phones to work reliably with TTYs. The industry is working to resolve this matter by October 1998.

[Optional: For more information, contact . . .]

DATE OF PUBLICATION:

APPENDIX C

TTY Forum Issue Statements

6.1   The TTY Forum doesn't support one solution over the other but it seems that the 2.5 mm jack is preferred

6.2   It is acceptable in concept to retrofit the TTY at no cost to the user. Concern was expressed regarding warranty work, and who would perform work on equipment. The retrofit should not eliminate or impact any functionality previously available to the user. Time to retrofit should be reasonable. A liaison should be established between manufacturers and user groups to ensure "certain conditions" are met.

6.3   The issue of the false propagation of errors, created by the incorrect receipt of a shift character should be addressed through use of an appropriate test script. The script should contain multiple shifts space apart so that a realistic distribution of character errors would result, based on frequent (although not universal) practice of correcting shift errors by user action. A normal distribution between 1 and ? with a median of about 8 would be appropriate.

9.1   The issue of whether less than full rate transmission is an acceptable solution, if it can be shown to provide improved CER performance.

9.2   The User Requirements Document will be modified by the consumers before the December TR45 meeting.

APPENDIX D

TTY FORUM MANUFACTURER TESTING COMPLETION MATRIX

Manufacturer	Technology	Through Put Test (Contribution)	Type of Test (Field, Lab)	Contact Name & Number
Philips	Analog	98.07.21.07		Ken Wells
Motorola	Analog	98.05.20.20	Lab	Paul Mollar
Sendele	Analog	98.07.21.05	Lab	Steve Sendele
Motorola	CDMA	98.05.20.20	Lab	Paul Mollar
Lucent	CDMA	98.05.20.10	Lab	Ahmed Tauf
Lucent	CDMA	No Gain Solution 99.01.26.09	Lab	Dr. Steven Benno
Lucent	CDMA	99.09..09.16	Fixed Point Proof / Concept	Dr. Steven Benno
Nokia	CDMA	98.05.20.17	Lab	Mohamed El-Rayes
Qualcomm	CDMA	98.05.20.12	Lab	Nikolai Leung
Motorola	CDMA	99.05.18.15	Lab	
Ericsson	GSM	98.02.11.07	Lab	Christopher Kingdon
Nokia	GSM	98.05.20.17	Lab	Mohamed El-Rayes
Motorola	GSM	98.05.20.20	Static	Paul Mollar
Ericsson	GSM	98.11.04.14	Static	Steve Coston
Ericsson	All Digial	99.09.09.12 / .13	Static	Steve Coston
Nokia	GSM/TDMA	99.09.09.15	Theory	Doug Neily
Ericsson	TDMA	98.02.11.05	Lab	Christopher Kingdom
Ericsson	TDMA	99.01.26.10	Field	Steve Coston
Motorola	TDMA	98.05.20.20	Field	Paul Mollar
Nokia	TDMA	98.05.20.17	Lab	Mohammed El-Rayes
Philips/CPT	TDMA	98.07.21.07	Field	Jim De Loach 510-445-5510
Lober & Walsh	TDMA	98.09.08.10	Lab	Josh Lober
CPT	TDMA	98.07.21.08	Lab	Josh Lober
Ericsson	TDMA	98.11.04.14	Static	Steve Coston
AWS	TDMA	99.05.18.11	Static	Adrian Smith
NOKIA	TDMA	99.05.18.14	Lab	Massoud Fatini

Lucent	TDMA/CDMA	99.05.18.13	Lab	Steve Benno
Ameriphone	TDMA/CDMA	99.05.18.12	Static	Peter Lee
Lober & Walsh	IDEN	98.09.08.11	Lab	Josh Lober

Notes on Evaluating Solutions against the User Requirements List

Judy Harkins and Norman Williams, Gallaudet University, May, 2001

Some of the carriers have indicated a need to include in their tests and evaluations all of the user requirements generated in 1998 in the TTY Forum. This document annotates the requirements with notes about evaluation issues and field test procedures from a user perspective. This is obviously not a test plan but is sent out primarily for generating discussion and giving general guidance from the user viewpoint.

1. The character error rate should approximate that of AMPS, which has been demonstrated at <1% for stationary calls. More research on AMPS performance with TTY would be useful to assist in specifying a range of conditions.

See appendix.

2. The TTY caller must be able to visually monitor all aspects of call progress provided to voice users. Specifically, the ability to pass through sounds on the line to the TTY (so that the user can monitor ring, busy, answered-in-voice, etc.) should be provided.

Suggestion: Generate all audio call progress signals (ringing, busy, fast busy, voice answer) and determine if there is an understandable visual indication for each. The line status light on the TTY will probably function appropriately in voice channel solutions, but this should be verified. Check that the visual indication is synchronized in time with the audio indication.

Comment: A particular issue in wireless telecommunications is that call to mobile phones often do not ring at all if the party is unavailable; a voice message is provided instead. There may not be a visual indication of the call status on the telephone. Another issue is that many phones revert to voice mail. In these situations, the TTY caller will not be able to monitor all aspects of call progress provided to voice users.

3. There must be a visual indication when the call has been disconnected.

Suggestion: Place call and have other side hang up. What visual indication is given? If the user can tell, by looking at the handset for example, that the call is terminated, then this criterion is met.

Comment: It would help all users to have an explicit message, but if this is not provided, the user should know what the screen will look like upon call termination.

4. A volume control should be provided.

Comment: Determine and document the optimum volume control setting for the TTY being tested. (If performance is affected by volume control, users will need to be informed of this, and how to use the volume control to obtain a low error rate.)

5. The TTY user must have a means of tactile (vibrating) ring signal indication.

Suggestion: Verify that the handset or accessory vibrates on receipt of calls (and preferably not at other times!). Can the tester receive calls in a timely fashion with the ringer turned off? (Test throughout the call; some external vibrators continue to vibrate throughout a call, which can be confusing.)

6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit Baudot signaling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)

Suggestion: On outgoing call, press keys on the TTY during ring signals and immediately after answer. Baudot tones should be clearly audible by the answering party. (This should not be a problem for voice channel solutions, but is worth some quick tests in the field.)

7. The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.

Comment: This issue appears to be moot and does not need to be tested.

8. The *wireless* party's TTY may require retrofitting, or a new model TTY to be developed, or the use of a portable data terminal such as a personal digital assistant.

Comment: This is not an issue for testing. However, if an accommodation is required, such as retrofitting, a special model, or a cable, this should be well documented so that consumers know what types of equipment they will need. If PDAs or paging devices are used in place of a handset and TTY combination, attention will need to be paid to the rate of input that can be achieved through the keyboard or virtual keyboard.

9. VCO and HCO should be supported.

Suggestion: Evaluating the efficacy of VCO and HCO:
- VCO and HCO should be tested as they will be implemented. For example, if a custom cable is needed, tests should be run with that cable as part of the set-up. If the user needs to take action between turns (e.g., pushing a button), it should be tested with consumers to check usability.
- Does the system deliver acceptable error rates with devices on the market that are designed to work in VCO and in a mobile environment? (Ameriphone Q90, Krown Pocket VCO, and the Ericsson handset adapter are the three known examples.)
- Is the quality of voice on VCO calls the same as on non-TTY calls? This can presumably be tested using standard industry methods for voice quality.

- Is there any delay or cut-off of characters or words when switching between voice and TTY?
- Is there greater chance of disconnect when switching between voice and TTY? Other problems?

10. Reduction of throughput (partial rate) on Baudot is highly undesirable and should not be relied upon to achieve compliance (see #7). It may be useful as a user-selectable option to improve accuracy on a given call.

This issue is now moot, and no tests are needed.

11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.

This would not appear to be a problem on voice channel solutions. On data channel solutions, the call would need to carry the same identifying information as would be carried were it in the voice channel.

12. On the landline side, the solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).

A variety of TTY models should be tested, but the amount of testing on each model will necessarily vary. The difficulty in testing with a large number of models is acknowledged, given the limitations in data capture possibilities with TTYs and some 911 TTY systems on the market. This may have to be handled by short tests – calling to direct-connect landline TTYs set to auto answer, where the tester can call send a string of identifying information about the call, which can then be sent back to the tester for scoring. This might be able to be arranged at Gallaudet if there is interest; more discussion is welcome. (Note that Gallaudet has produced some software tools and documentation for partially automated two-way TTY testing: www.tap.gallaudet.edu/ttytools

13. Drive conditions must be supported, again using AMPS as a benchmark.

Tests for drive conditions should be run using carriers' individual methodologies and facilities. The consumer's goal is to be able to use the TTY and telephone while a passenger in a car, while on a train, etc.

Appendix   User Requirement 1: Error rate of TTY over Wireless telephones

- Interoperability among handsets and infrastructure vendors should be tested using industry's usual tests.

- Varying signal conditions need to be tested.

- Varying network conditions need to be tested.

- Data should be collected and scored on both sides (directions) of the call wherever possible.

- See Requirement 12 on accommodating a range of TTY models. Compatibility testing with 9-1-1 TTY equipment should be coordinated via Toni Dunne.

- See Requirement 13 on drive tests.

- Calls through relay should be placed. A hearing person on the landline side should read one side of the script. (This is an example of where random characters will not be helpful). Relay operators cannot retain conversations; unless special arrangements can be made with TRS providers for test calls, the only way to ascertain is to ask the relay operator if the incoming text was garbled.

- We tentatively recommend that Lober and Walsh's SCORE program be used as this was developed through the TTY Forum. There is some indication based on limited tests that the Ericsson program results in a higher error rate.

- Scripts: A few comments -- Consumers have had the concern that the error rates generated by the TTY Forum's random character set may be inflated due to the excessive number of register shifts (sending a shift character between each figure/letter transition) in this script. It is not possible to eyeball the results in the field because of the random characters. The random character file also transmits only at full rate – there are no pauses.

Matt Kaltenbach of Ericsson has suggested that it would be helpful to base at least one script on the bit structure of Baudot or some other mathematical basis that would allow for diagnosis of problems in the field.

Gallaudet has produced a series of scripts that use conversational language and naturals shifts between letters and figures, pauses in typing and simulation of two typing speeds.   These are available at http://tap.gallaudet.edu/ttytools

Comment on the 1% benchmark: It was our intention, when we wrote this requirement, that 1% would apply to reasonable signal conditions and network conditions, and *not* that a maximum of 1% error rate must be met on every single call in the presence of severe (and rarely occurring) impairments.

APPENDIX E

TTY USER REQUIREMENTS

September 10, 1998

To: TTY Forum

Fr: Consumer Representatives

The CTIA has said that most of the consumer criteria previously submitted were not usable by the TTY Forum because the criteria covered marketing and distribution as well as design. Marketing and distribution issues for a possible "one-phone-model-per-technology" short-term plan will be taken up with CTIA's senior management, as suggested by them.

This contribution is a new set of criteria to address only functional characteristics of the solutions. The new criteria also reflect new information from the Forum since the first list was drawn up. It is intended to cover any solution.

1. The character error rate should approximate that of AMPS, which has been demonstrated at <1% for stationary calls. More research on AMPS performance with TTY would be useful to assist in specifying a range of conditions.

2. The TTY caller must be able to visually monitor all aspects of call progress provided to voice users. Specifically, the ability to pass through sounds on the line to the TTY (so that the user can monitor ring, busy, answered-in-voice, etc.) should be provided.

3. There must be a visual indication when the call has been disconnected.

4. A volume control should be provided.

5. The TTY user must have a means of tactile (vibrating) ring signal indication.

6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit baudot signaling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)

7. The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.

8. The *wireless* party's TTY may require retrofitting, or a new model TTY to be developed, or the use of a portable data terminal such as a personal digital assistant.

9. VCO and HCO should be supported where possible.

10. Reduction of throughput (partial rate) on Baudot is highly undesirable and should not be relied upon to achieve compliance (see #7). It may be useful as a user-selectable option to improve accuracy on a given call.

11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.

12. The solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).

13. Drive conditions must be supported, again using AMPS as a benchmark.

TTY/TDD Forum – 18
June 12, 2001
ATIS Conference Center
1200 G Street, NW, Suite 500
Washington, DC

TTY Forum

TTY User Intervention (*i.e.,* mode switch)

Questions:

1. How often does this have to be done?

2. How many steps are there?

3. How complicated are the steps?

4. Is it easily discovered without using the user's manual?

5. Is it clearly documented?

6. Is there a visual status indication?

    - During set-up?

    - Ongoing?

7. Does it interfere with other features? (e.g., dialing features, DTMF, etc.)

8. Will it be possible to make a voice call while in TTY mode?

9. Will VCO be a choice or will it be supported as a TTY mode? (Will VCO be incorporated into this mode or is there a series of choices in TTY mode?)

10. How long does it take? How fast can you set it up?

11. Is it possible to change modes during a call?

12. Is it standardized across handsets?

13. Is the process of hooking up the equipment and putting it into TTY mode too long or arduous to be able to answer a call in time?[1]

14. When receiving an incoming call, does the phone vibrate? Does the vibrator continue to work when an audio cable is inserted into the jack?

---

[1] Can a user set up the equipment and get into TTY mode before the call is disconnected or goes to voicemail? Can the phone be answered prior to being connected to equipment?

September 14, 1999

To: TIA TR-45.3

Fr: Consumer Representatives, Wireless TTY Forum
       Authors: Judy Harkins, Gallaudet University and Dick Brandt, dB Consulting as
       consultant to Gallaudet
       David Baquis, Self Help for Hard of Hearing People, Inc.
       Alfred Sonnenstrahl, Consumer Action Network
       Claude Stout, Telecommunications for the Deaf, Inc.
       Karen Peltz Strauss, National Association of the Deaf
       Norman Williams, Gallaudet University

Re: Guidance to TR-45 on Proposals for Solutions to TTY over TDMA

Presentations on three of the proposals being considered by TR-45 for the TDMA TTY solution
were made at the September 9, 1999 meeting of the Wireless TTY Forum. Given the timeframe
TR-45 is operating under, and given that the FCC has directed industry to consider consumer
issues in determining solutions, we offer this document as guidance to TR-45 as it considers the
alternatives.

The information presented at the September 9 meeting was, in some cases, sufficiently sketchy
that consumers were unable to ascertain the functional implications of the proposals. Some
presentations were also done very late in the process, so there is not sufficient time for analysis.

We do not state a preference for any proposal but hope the following discussion will be helpful.

General Questions and Issues:

1. There is a concern among consumers about the implications of roaming among digital
    technologies in the future, if a variety of approaches for TTY access are used. Thus we
    believe consistency in approach across technologies is needed. One of the carriers also
    strongly expressed this view. This problem needs to be solved for the long term, not just for
    the current situation where roaming tends to go to the more-accessible analog network. Once
    these solutions are implemented, if problems arise, consumers will have great difficulty
    having them addressed because the solutions are within the network and customer service
    personnel will not be equipped to deal with them.

2. Has there been any analysis indicating that approaches which propose network changes in
    switches versus changes in base stations, would lead to earlier availability as claimed?
    Consumers are interested in seeing solid, lasting and effective solutions, and the speed of
    implementation, while important, should not override usability considerations.

3. All test results presented to date have been obtained using blocks of data sent out from a file
    stored either in a TTY or in a computer and sent via a TTY modem. It has been noted in tests

run by Gallaudet that results obtained in an interactive mode (two people typing to each other) yielded poorer accuracy. Thus proposals that show errors in transmission should be scrutinized carefully. A full range of system impairments has either not been used in simulation testing or not reported on all of the solutions.

4. Non-activated phone support for 9-1-1 calls is required by the FCC. Has this been considered in the proposals? (See class mark discussion below.)

Appraisal of Specific Solutions:

Vocoder solution. From a consumer perspective, the Lucent "no gain" solution has been most thoroughly presented and appears to have the most transparent accessibility and the most support for consumer needs and requirements. The inclusion of error correction is a major benefit, given that the air interface presents new challenges to TTY transmission. Other, comparable proposals may also have merit (e.g., Nokia), but they have not been thoroughly explained so that consumers can compare them.

Code conversion. The Ericsson (and Nokia?) Code conversion ("tone") proposals appear to offer the possibility of earlier implementation (see 2 above) and the ability to use many existing handsets, but have the potential of putting the retrofit burden on the consumer. They raise the following concerns:

1. Smart Cable: Consumers are not opposed to the idea of including intelligence in the cable per se, however the following concerns exist:
   1.1. How would this intelligence be powered? (This question could not be answered at the Sept. 9 meeting.) There is opposition to the requirement for an additional battery for reasons of cost, bulk, and reliability.
   1.2. Who would make and provide the cable?
   1.3. Would this intelligence be built into the regular cable product line or would this be a primarily or exclusively "deaf" product? If the latter, experience shows that provisioning and cost may be serious problems. Customers often have to wait many weeks for "special" accessories. We realize standards bodies do not ordinarily address cost issues, but please consider the additional cost of a phone that vibrates (over a low-end phone), the cost of the TTY, and now the potentially high cost of a special-purpose cable with a small market.
   1.4. Would one cable fit all (thereby lowering the price and expanding the availability)?

2. Class Mark: Any system that relies on the phone having a class mark denoting that the user uses a TTY is not likely to be successful, because many deaf and hard of hearing people consider self-identification as a possible threat to their security. 9-1-1 operators have never been successful in having deaf and hard of hearing subscribers "sign up" as a TTY telephone number. The procedure is fraught with potential problems and snafus. When someone roamed into a carrier using this solution (not marked), what would happen? Hearing people who use TTYs may not realize they need to enroll their phones. People who have a phone and acquire a TTY later (e.g., after onset of hearing loss) would find the TTY does not work. TTY users could not use someone else's cell phone. One solution to this problem suggested

at the forum was to mark all phones as TTY. Would carriers agree to this?   In short, a system that provides automatic detection of the TTY signal is preferable.

IWF.   Although we recognize that IWF proposals are not a part of the present TR-45 TDMA TTY discussions we would also like to provide the following for your information, as they should be considered in development of proposals:

1. There is a strong desire for VCO/HCO capability, which appears to be difficult to implement in IWF solutions at the present time.
2. There is also a strong desire for provision of the line signal power indicator (flickering light) used to interpret call status.
3. Consumers are opposed to (and the DOJ has mandated against) requiring any form of special dialing (e.g., two-stage) or conditioning sequences (e.g., #NN) to reach 9-1-1.
4. It will be important that the delay between powering on a data device and dialing out not exceed the delay experienced with a voice call.

Appendix: Consumer requirements with comments regarding proposed solutions:

1. The character error rate should approximate that of AMPS, which has been demonstrated at <1% for stationary calls. More research on AMPS performance with TTY would be useful to assist in specifying a range of conditions.

Comment: All proposals presented to date appear to meet this criterion. Consumers are concerned that there be sufficient testing to validate this in the field.

2. The TTY caller must be able to visually monitor all aspects of call progress provided to voice users. Specifically, the ability to pass through sounds on the line to the TTY (so that the user can monitor ring, busy, answered-in-voice, etc.) should be provided.

Comment: All proposals claim to meet this criterion and we have no concerns. (IWF solutions may, however, not be able to meet this one.)

3. There must be a visual indication when the call has been disconnected.

Comment: This specific issue has not been addressed in presentations but is covered by most if not all systems by a message on the display of the phone.

4. A volume control should be provided.

Comment: This item is intended to allow the TTY user to adjust volume for better reception of TTY tones as necessary. Most if not all handsets include this feature anyway. It has not therefore been addressed in presentations on solutions.

5. The TTY user must have a means of tactile (vibrating) ring signal indication.

Comment: Again, this is an issue of general provisioning and not related to voice-channel solutions. (However, this will be an issue in IWF solutions.)

6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit Baudot signaling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)

Comment: All voice-channel solutions to date appear to support this.

7.   The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.

Comment: All solutions to date appear not to require retrofitting of the landline TTY.

8. The wireless party's TTY may require retrofitting, or a new model TTY to be developed, or the use of a portable data terminal such as a personal digital assistant.
Comment: Solutions that do not require retrofitting or special treatment are preferred by consumer representatives.

9. VCO and HCO should be supported where possible.

Comment: Voice-channel solutions presented to date appear to support this requirement. (IWF solutions may not, however.)

10. Reduction of throughput (partial rate) on Baudot is highly undesirable and should not be relied upon to achieve compliance (see #7). It may be useful as a user-selectable option to improve accuracy on a given call.

Comment: No solution presented to date reduces throughput, as nearly as we can tell. This should be verified with the companies proposing solutions.

11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.

Comment: Voice channel solutions should not cause a problem with this.

12. On the landline side, the solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).

Comment: This is of concern because of limited testing of solutions to date.

13. Drive conditions must be supported, again using AMPS as a benchmark.

Comment: This requirement has not been adequately addressed by testing.

APPENDIX F

WORK PLAN

Published as a separate TTY Form Document

APPENDIX G

Typical Operating Characteristics for Wire-Line Based TTYs

The following is a technical description of the typical operating characteristics for existing wire-line based Text-Telephones for the Deaf (TTYs). This document is not intended to be a performance description of any one product, but to give a representation of performance of the majority of the product supplied to wire-line TTY customers in the last five years. TTY manufacturing representatives has reviewed this information and agrees that it represents an accurate account of the performance characteristics of existing wire-line products.

It should be noted that it is not possible to precisely define performance for all products, in all situations, in the field. Variation beyond this technical representation does exist for older product, products that are no longer supported by a manufacturer, individual products that are not operating correctly and improper use of product. It is not possible to report this additional range of variation, only to say that these products performance would suffer on either a connection to wire-line or wire-less TTY.

TECHNICAL BACKGROUND
For Frequency Shift Keying (FSK) two signal frequencies are required to modulate the asynchronous serial data to be sent over the conventional voice grade telephone lines of the switched telephone network. For Baudot communications to be useful on the Public Switch Telephone Network (PSTN) these frequencies fall within the central portion of the telephone line pass-band (300 – 3300 Hz).

The two frequencies of the transmitted signal must be sent in accordance with FCC requirements defined in dBm (decibels with reference to a power of one milliwatt for metallic connections, where 0 dBm = 1 milliwatt). The acoustic measurements are in dBSPL for acoustic configurations. This signal is measured at the TTY interface, either at the metallic connections or where it is acoustically coupled to the telephone network.

The receive level, commonly referred to as sensitivity, is also given for each pair of frequencies. This signal, also measured in dBm for direct connections and dBSPL for acoustic configurations, is the typical signal measured at the connection that will result in error-free reception of a test message.

BAUDOT CODE OPERATION
All TTYs provide Baudot code operation employing half-duplex, simplex, asynchronous, FSK transmission.

Frequencies
Baudot code operation used the following frequencies:

Signal	Frequency	Tolerance	
		Transmit	Receive
Mark	1400 Hz	±1%	±4%
Space	1800 Hz	±1%	±4%

Bit Duration
The bit duration is 22.00 milliseconds (ms) ±0.40ms to provide a nominal baud rate of 45.45 bits per second.

CHARACTER FORMAT

Transmit
  The Baudot code for each character is transmitted with the following format, the data bits assigned are in accordance with Table 1.2 with a "1" in the binary representation transmitted as a mark and a "0' as a space.

Bit	Start	Data	Data	Data	Data	Data	Stop
Signal	Space	LSB	Bit 2	Bit 3	Bit 4	MSB	Mark
Number of Bits	1	1	1	1	1	1	1.5-2.0 2.0 Typ.

Table 1.1

  Where the LSB is the Least Significant Bit and the MSB is the Most Significant Bit. The bits shall be transmitted from left to right.

Receive

The TTY is capable of receiving characters with the format of Table 1.1 with a stop bit of at least 1.0 bit length or longer. The receiver is capable of receiving characters either with the space tone of the start bit as the first tone received or with a mark tone preceding the start bit.

Mark Hold Time

The mark hold time defines an additional period of time during which the TTY transmits a mark hold tone (1400 Hz) following the last character transmitted. Mark hold tone is not transmitted between each character if the character is followed immediately by another character. The mark hold tone is transmitted for a period between 150ms to 300 ms after the end of the stop bit(s).

Transmit Levels		
Coupling Method	Level	Range
Acoustic Direct Connect	108 dBSPL -10 dBm	±6 dB * - 3 ,+1 dB

Sensitivity Levels		
Coupling Method	Level	Range
Acoustic Direct Connect	72 dBSPL -40 dBm	±6 dB * ±5 dB

Most receivers are capable of receiving signal up to at least –5dBm.

* NOTE: Acoustic performance variations greater than listed may be encountered and are a result of many variables including the type of telephone handset used and how well the acoustic coupling is made by the user. It is not possible to report this additional range of variation, only to say that these products performance would suffer on either a connection to wire-line or wire-less TTY.

TABLE 1.2

Set of Baudot Codes for TTYs

	DEC	HEX	BINARY	LETTER	FIGURE
0	00	00000	BackSpace	BackSpace	
1	01	00001	E	3	
2	02	00010	LF	LF	
3	03	00011	A	-	
4	04	00100	Space	Space	
5	05	00101	S		
6	06	00110	I	8	
7	07	00111	U	7	
8	08	01000	CR	CR	
9	09	01001	D	$	
10	0A	01010	R	4	
11	0B	01011	J	'	
12	0C	01100	N	,	
13	0D	01101	F	!	
14	0E	01110	C	:	
15	0F	01111	K	(	
16	10	10000	T	5	
17	11	10001	Z	"	
18	12	10010	L	)	
19	13	10011	W	2	
20	14	10100	H	=	
21	15	10101	Y	6	
22	16	10110	P	0	
23	17	10111	Q	1	
24	18	11000	O	9	
25	19	11001	B	?	
26	1A	11010	G	+	
27	1B	11011	FIGS	FIGS	
28	1C	11100	M	.	
29	1D	11101	X	/	
30	1E	11110	V	;	
31	1F	11111	LTRS	LTRS	

Note: CR and LF may be manually or automatically generated by the TTY. If automatic generated, the sequence may contain an extra (non-printable) character to provide adequate time for older electromechanical TTYs to respond. CR & LF are inserted into the transmitted characters after a maximum of 72 characters to allow for the carriage return of older electromechanical TTYs.

APPENDIX H

Modem / IWF Manufacturer Contact List

List of Names and Addresses to Receive IWF Letter

Title	FirstName	LastName	JobTitle	Company	Address	Address 2	City	State	Zip
Ms.	Veda	Krishnan		Cirrus Logic	110 Horizon Drive #300		Raleigh	NC	27615
Mr.	Zarko	Draganic	CEO	Alto Com Inc.	257 Castro Street	Suite 233	Mountain View	CA	94041
Mr.	Edward	Campbell		3Com					
Mr.	Raouf	Halim	VP and General Manager, Network Access Division	Rockwell Semiconductor Systems	4311 Jamboree Road		Newport Beach	CA	92660-3095
Mr.	Aaron	Fisher	Vice President, Wireless Products	Lucent Technologies	Room 55F-311	1247 S. Cedar Crest Blvd.	Allentown	PA	18105-6209
Ms.	Judy	Sheff	VP Intellectual Property	Lucent Technologies	Room 5SF18	2 Oak Way	Berkeley Heights	NJ	07922-2747
Mr.	Greg	Garen	General Manager Modem and Multimedia Products	Lucent Technologies - Microelectronics Group	Room 22W-219(Mail Stop EQ)	555 Union Blvd.	Allentown	PA	18103-1229
Mr.	Warren	Henderson	CEO	Henderson Laboratories					
Mr.	Moiz	Beguwala	VP and	Rockwell	4311		New	CA	926

Title	FirstName	LastName	JobTitle	Company	Address	Address 2	City	State	Zip
			General Manager, Personal Computing Division	Semiconductor Systems	Jamboree Road		port Beach		60-3095

CC: National Association of State Relay Administration (NASRA)
Merilyn Crain, Chair
315 So. College Rd. Suite 208
Lafeyette, LA 70503

IWF letter dated November 16, 1998

Sent to:
3Com
Mr. Zarko Draganic, CEO, Alto Com Inc.
Ms. Veda Krishnan, (to be supplied) Cirrus Logic
Mr. Aaron Fisher, Vice President, Wireless Products, Lucent Technologies
Ms. Judy Sheff, VP Intellectual Property, Lucent Technologies
Mr. Greg Garen, General Manager Modem and Multimedia Products Lucent Technologies -
Microelectronics Group
(To be supplied), Motorola
Mr. Raouf Halim VP and General Manager, Network Access Division, Rockwell Semiconductor
Systems
Mr. Moiz Beguwala, VP and General Manager, Personal Computing Division, Rockwell
Semiconductor Systems

Dear Sir/Madam

In response to a FCC inquiry, the Cellular Telecommunications Industry Association (CTIA) and
the Personal Communications Industry Association (PCIA) have established a technical forum to
address the issue of providing reliable communications for deaf and hard of hearing people over
digital wireless systems. Specifically this forum is addressing the issue of deaf and hard of
hearing people using digital wireless connections to access 9-1-1 centers.

A solution that appears to offer promise for the longer term, involves the use of new (or
modified) communications terminals, used by deaf and hard of hearing people, (TTYs)
connected through a serial interface to the digital cell phone. The data channel, provided by the
air interface, would then be used to effectively extend this interface to the network. This of
course, would require the use of an Interworking Function (IWF)*[2] in the network that would be
capable of supporting TTY communications. We are aware that some of the IWFs being
developed will support 45.45 Baudot TTY transmission (the transmission mode most commonly
used by deaf and hard of hearing people in the United States). While this caters well to the
present need, it has the drawback that it locks deaf and hard of hearing people into this older
technology.

A more desirable solution would be one which would involve the use of ITU-T
Recommendation, V.18, that specifies a protocol, which provides for higher speed ASCII based
communications while at the same time maintaining compatibility with today's Baudot TTY
devices. The problem with this solution is that V.18 has yet to be implemented by any major
modem manufacturer. We have, however, been given a presentation by a UK based company
that has developed a prototype "stand alone" V.18 product which it plans to introduce
commercially early next year. In addition to this, we have been given a demonstration of an in-
service Swedish IWF, which incorporates V.18 functionality. It might also be of interest to note

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[2] The term IWF is used in its broadest sense in this letter. (See the definition in TIA TSB-100)

that the service provider sees text telephony as a generic service (e.g. not just for deaf or hard of hearing). These two events may be moving V.18 into the readily achievable category.

It seems likely that if the IWF function and the modems installed at the 9-1-1 centers were to incorporate V.18 capability, connections could be made at the higher V.18 rates. Likewise it would appear that the connect time could be shortened as V.18 incorporates a calling tone, which could be instantly recognized by equipment at the 9-1-1 centers, thereby eliminating the loss of precious time, which is normally incurred while attempting to determine the source of a "silent" call.

Assuming that you agree that the timely provision of this functionality is important, we are hoping that you can provide us with an indication of when we might expect to see products (e.g. consumer modems, IWFs) from your company that implement V.18. Any information you could provide to us, by 4th Quarter 1998, would greatly help us in developing our response to the FCC.

APPENDIX I

TTY Forum Chair's Update Memorandums

Date: March 22, 1999

FM: TTY Forum Co-Chairs; Ed Hall, CTIA and Todd Lantor, PCIA
TO: TTY Forum Members and Interested Parities

RE: TTY Forum Update

Greetings,

A recent conversation with Dr. Steven Benno of Lucent Technologies has informed us that he has completed the Lucent software simulation of the TTY "no-gain" solution and it is now released and available to all those interested in exploring its functionality, compatibility and potential benefits with various CLEP vocoders. According to Dr. Benno, the following equipment and infrastructure vendors have requested a copy of his newly released code for testing purposes; Ericsson, Motorola, Nokia, NORTEL and Qualcomm. As co-chairs, we remain hopeful that this Lucent contribution will spark an interest for some manufacturers to re-visit their past efforts with vocoders, which perhaps may lead to follow-on contributions at our next TTY Forum.

During the last TR45 meeting, (March 3-4) CTIA submitted the 2.5mm Jack SRD, on behalf of the Forum. TR45 accepted this contribution and remanded it to the TDMA (TR45.3) and CDMA (TR45.5) sub-committees for information and to the appropriate sub-committee (TR45.1) for Action. Likewise, the TDMA and CDMA sub-committees reported back to the Chair that both of these digital technologies have developed standards supporting the Inter-working Function (IWF) as described in the TTY Forum's SRD on Circuit Switched Data submitted during the December TR45 meeting. This news brings the industry one step closer to the Forum's proposed "long term" data solution. The willingness of some modem manufacturers (3COM) to support the V.18 protocol is the other critical issue needed to make the IWF a viable option to carriers as a means of supporting TTY over digital - long term. The IWF solution opens the doors to the future by allowing end-users the use of ultra-light computers, compact PDA's, etc.

At this point I think it is important to remember that it has been the synergy, team-spirit and positive environment provided by the members of the TTY Forum that has lead us to this point. But, we do not want anyone to have the false impression that the end-all, be-all solution(s) have thus far been developed. Although Dr. Benno's "no-gain" solution remains a major breakthrough for TTY, "short term", voice based (specifically CLEP vocoders) solution and the V.18 protocol a major breakthrough for TTY "long term", data solution these by no means require carriers or manufactures to implement anyone one or both of these solutions. Keep in mind the other solutions brought to the Forum by Lober and Walsh and Ericsson. These solutions have also proved to be quite successful and promising for certain digital technologies. It is important to keep in mind that the carrier is responsible for the selection and implementation of a solution(s) that will allow TTY users to access 9-1-1 over its digital system. The best we as a Forum can do at this point is continue to provide the positive environment, feedback and input to manufacturers and carriers regarding testing and consumer needs and requirements and keep the standards development bodies involved when needed. CTIA and PCIA remain committed.

In conclusion, we propose that at the next TTY Forum we initiate the process to develop the final report to the FCC. Based on the contributions received to date and those anticipated at our next meeting, we believe we will have sufficient information to develop specific comments and recommendations. The TTY Forum can then plan to meet on a quarterly basis to "evaluate" progress and provide the FCC with a periodic, implementation status report.

My thanks to all members of the TTY Forum. Looking forward to seeing everyone in May.

July 23, 1999

Fm: TTY Forum Co-Chairs
TO: TTY Forum

RE: Update: TTY Forum and Interested Parties

Todd Lantor and I would like to take this opportunity to provide you with an overview of some interesting developments that have come to our attention since the last Forum held on May 18th, 1999.

The Lucent "no gain" vocoder solution has been widely accepted by TR45.5, the CDMA air-interface standards group. The "no gain" solution draft standards document has recently been prepared for ballot. Assuming a "clear" ballot response, the industry may have a CDMA TTY standard as early 4Q99. Likewise, TR45.3, the TDMA air-interface standards group is actively pursing the same course as the CDMA group. The Nokia variation, presented to the Forum during the May meeting is being reviewed and considered. The group plans to complete its deliberation quickly and move toward the final stages by preparing a draft document for ballot.

Ericsson has provided the co-chairs with a copy of a document that proposes an alternative approach to the Lucent "no gain" vocoder solution. In the interest of time, and to take advantage of the TR45.3 meeting cycle, Ericsson thought it prudent to submit the alternative approach directly to the TDMA working group. Although it is being discussed at standards, Ericsson will present this vocoder alternative at the upcoming September TTY Forum.

Concurrently, we are preparing a draft "TTY Forum Status Report" for the FCC. The report, as a minimum, will contain the following sections:
- Updated Work Plan
- TTY testing completed to date
- A Technical Standards Update
  - Voice Based Approach
  - Data Approach
- Comments and Recommendations

Todd and I plan on getting a draft of this report to the TTY Forum Steering Committee for their review and approval before the next TTY Forum: The Steering Committee is comprised of: Toni Dunne, Texas 9-1-1; Billy Ragsdale, Bell South; Claude Stout, TDI; Norm Williams, Gallaudet UN; Jeff Crollick, TIA; John Melcher, NENA.

Next Meeting: We are currently making arrangements for the **September 9**, **1999** TTY Forum and will get the meeting logistics out separately.

The meeting will be in the **Washington DC** area but WILL NOT be at Gallaudet Univ. Their calendar cannot support us. The meeting will start at **9:00 AM** and adjourn at 5:00 PM. Please do not make travel arrangements leaving the DC area before 6:30 PM. Now that we have reduced the meetings to one day, I see this Forum's agenda as being quite full.

Thank you all and have a very cool and pleasant summer. See you September!

Appendix J

Technical Standards Reference

ID	**Description**
TIA/EIA 825	FSK
TIA/EIA TSB-121	"2.5 mm AUDIO INTERFACE FOR MOBILE WIRELESS HANDSETS - TEXT TELEPHONES (TTY)"
TIA/EIA-IS-823 (PN-4614)	TR 45.3 5.3 TDMA TTY Solution- 410 vocoder
TIA/EIA-IS-840 (PN-4721)	TR 45.3 5.3 TDMA TTY Min Performance.
TIA/EIA/IS-789-A:	Electrical Specification for the Portable Phone to Vehicle -
IS-733-1, IS-127-2	CDMA Vocoder Standards - high rate
IS-707-A-2	CDMA Data (V.18) Standard
TIA/EIA-136-270-B	TDMA Third Generation Wireless – Mobile Stations Minimum Performance
TIA/EIA-136-280-B	TDMA Third Generation Wireless – Base Stations Minimum Performance
3GPP TR26.226	Cellular Text Telephone Modem Description
3GPP TR26.230	Cellular Text Telephone Modem Transmitter Code
3GPP TR26.231	Cellular Text Telephone Modem Minimum Performance Specifications

Timeline of Events in CDMA and TDMA standards

CDMA: TIA TR45.5.1.1
====================
August 2000: Lucent proposed bug fixes to the TTY/TDD addenda and proposed a TTY/TDD Minimum Performance Specification for CDMA.

November 2000: Nortel proposes to add a test vector to the Min Perf Spec in order to handle the hard handoff scenario. This scenario uncovers another bug in the code.

Dec 2000: Lucent proposes another bug fix, which is approved, but the subcommittee doesn't baseline the fixes in order to give more time to find problems.
Jan 2001: Updates to the TTY specifications and Min Perf Specs are baselined and sent to V&V.

TDMA: TIA TR45.3.5
==================
October 2000: Proposed bug fixes to IS-823 TTY Extension to TIA/EIA 136-410.

December 2000: Proposed additional bug fix similar to the bug fix proposed for CDMA in Dec. 2000.

January 2001: Nokia and Ericsson present contribution questioning the necessity of any bug fixes. Nokia proposes change to standard to improve TTY performance during signaling.

February 2001: A problem is found with IS-840 TTY/TDD Min Perf Spec for TDMA. Nokia (the editor) will provide an update to fix problem and update based on Nokia's proposed change to IS-823.

March 2001: Changes to IS-823 are approved. Nokia commits to having a new version of IS-840 for review by next meeting. The subcommittee decides to ballot new versions of IS-823 and IS-840 together.

APPENDIX K

Glossary of Terms

Telecommunications Standards and Assignment Organizations

ANSI - American National Standards Institute
> The ultimate accolade for any standard is ANSI certification. This does not mean that ANSI has reviewed the standard, but that it has been circulated widely throughout the industry and that it conforms to their document design and publication guidelines. TIA standards, for example, start their public life as an IS- (Interim Standard) and then proceed within a few years to a full ANSI standard. The analog cellular standard started as EIA/TIA IS-3 and is now the ANSI standard identified as EIA/TIA-553.

ATIS - Alliance for Telecommunications Industry Solutions
> The major US telecom standards organization beside the TIA, most responsible for ANSI SS7 standards. This organization was previously called ECSA; Exchange Carriers Standards Association. SS7 and wireless standards are developed within the T1 committee.

Bellcore - Bell Communications Research
> Bellcore is not a standards organization, but they do write technical documents that are treated as if they were standards by many telecommunications carriers, particularly their former owners, the 7 regional bell operating companies. These documents include the GR-145 specification for interconnect, enhanced SS7 specifications beyond ANSI and the WACS low-mobility PCS system. Bellcore also performs many other research and consulting functions.

ETSI - European Telecommunications Standards Institute
> The mission of ETSI is "to produce the technical standards which necessary to achieve a large unified European telecommunications market". This includes the specification of the GSM cellular and PCS standard.

IFAST - International Forum on ANSI-41 Standards Technology
> A forum on international cellular carriers, vendors and service providers that attempts to resolve international roaming problems with AMPS-compatible systems (i.e. including IS-136 D-AMPS and IS-95 CDMA). The organization has taken responsibility for allocating the International Roaming MIN resources (MIN's starting with the digits 0 or 1) and new blocks of SID codes.

INC - Industry Numbering Committee
> The Industry Numbering Committee (INC) is a standing committee of the Carrier Liaison Committee (CLC). The INC provides an open forum to address and resolve industry-wide issues associated with the planning, administration, allocation, assignment and use of resources and related dialing considerations for public telecommunications within the North American Numbering Plan (NANP) area.

ITU - International Telecommunications Union
> The ITU is the global equivalent of ANSI for telecommunications standards. In fact, the world is divided into the majority of countries that adhere to ITU standards, and the US and Canada that tend to use ANSI standards. AMPS cellular is an exception, as it

has been implemented in many other countries. ITU standards that are used in AMPS cellular include: E.164 - the global numbering plan. E.212 - the global mobile identification plan. Q.7xx - a series of standards defining Signaling System #7 (used as an alternative to ANSI SS7 in AMPS countries outside the US and Canada).

NANPA - North American Numbering Plan Administration

The organization responsible for allocating numbering resources within the North American Numbering Plan Area: USA, some of its territories, Canada and several Caribbean nations. Controlled by Bellcore until January 1998, it is now managed by Lockheed-Martin. It is responsible for assignment of new area codes within the North American Numbering Plan and office code assignments within US states and territories.

NENA - National Emergency Number Association

NENA, along with NASNA (National Association of State 9-1-1 Administrators), APCO (Association of Public Safety Communications Officials) and the TIA are responsible for promoting enhanced 9-1-1 standards for wireless systems.

TIA - Telecommunications Industry Association

WWITF – Wireline Wireless Integration Task Force

Government and Regulatory Organizations

Australian Communications Authority (ACA)

The organization responsible for the management of radio spectrum and telecommunications in Australia, formed by a merger of AUSTEL and SMA. APUMP represents people who are unhappy   with the decision to eliminate analog cellular by the year 2000 in favor of the three GSM systems.

RSP - New Zealand Radio Spectrum Authority

Responsible for the management of radio spectrum in New Zealand.

US Dept. of Commerce

The Office of Telecommunications provides a great online source of worldwide wireless telecommunications information.

FCC - US Federal Communications Commission

The organization responsible for the management of telecommunications in the United States. Their responsibilities for public radio communications, such as cellular, include allocation of frequencies, the development of regulations that govern their use and monitoring to ensure that regulations are followed.

Wireless Telecommunications Trade Associations

ATIS – Alliance for Telecommunications Industry Solutions

CTIA - Cellular Telecommunications Industry Association

A trade association of wireless carriers in the United States, Canada and other countries. Originally a cellular organization, it now has members that are Manufacturers, PCS, ESMR and Satellite carriers.

CWTA - Canadian Wireless Telecommunications Association

A trade association of wireless carriers in Canada.

MMTA - Multi-Media Telecommunications Association

An association of companies focused on computer-telephony integration. They announced in November 1996 that they were merging with the TIA.

PCIA - Personal Communications Industry Association
    Formerly Telocator, this organization represents Paging, PCS, ESMR, SMR and
    mobile data service providers as well as communications site managers, equipment
    manufacturers, and others providing products and services to the wireless industry.
TIA - Telecommunications Industry Association
    United States Telephone Association.
    A trade association for US local exchange carriers.

Wireless Forums

CDG   CDMA Development Group
        A trade association dedicated to the promotion of CDMA wireless technology.
MIPS   Mobile Internet Phone Services Forum
        A new group dedicated to promoting the development of Internet access technologies,
        services and features from mobile devices.
PACS Providers Forum
        PACS (Personal Access Communication System) is a PCS system based on Bellcore's
        WACS and Japan's PHS, that will provide 64kbps voice and data, but is restricted to
        low mobility applications.
Universal Wireless Communications Consortium
        Promoters of the IS-136 TDMA digital cellular and PCS standards, mostly through
        conferences and symposiums.
WDF   The Wireless Data Forum is an independent, protocol-neutral trade group dedicated to
        promoting the wireless data industry. WDF's members include wireless operators and
        equipment providers, application developers and information technology companies
        working to advance wireless and mobile data products and services.

Glossary

Analog Signal A signal that varies in a continuous manner, such as voice.
ANI Automatic identification of the calling station
ANSI American National Standards Institute.
ATIS Alliance for Telecommunications Industry Solution (formerly ECSA). Responsible for
ANSI SS7 standards and US GSM standardization.
BS Base Station
CPAS Cellular Priority Access Service
ESN Electronic Serial Number
GETS Government Emergency Telephone Service
HLR Home Location Register (database of subscriber records)
IFAST International Forum for AMPS Standards Technology
INC Industry Numbering Committee
IS TIA Interim Standard.
JEM Joint Experts Meeting
J-STD Joint ATIS and TIA standard.
LERG Local Exchange Routing Guide

LEA Law Enforcement Agency
MS Mobile Station (i.e. wireless phone)
MSC Mobile Switching Center (aka MTSO)
NAG Numbering Advisory Group
PACA Priority Access Channel Assignment
PN TIA Project Number. Identifies a project during development of a standard.
SP ANSI Standards Proposal. ANSI equivalent of a PN
TLDN Temporary Local Directory Number
TIA Telecommunications Industry Association
TTY Text Telephony
TDD Telecommunications Device for the Deaf
VLR Visited Location Register
WIN Wireless Intelligent Network

APPENDIX L
Industry Implementation Status Reports
Contained within are written industry TTY implementation status reports as submitted to the Secretariat.

Table of Contents

Please Note: AT&T Wireless' current network, supporting approximately 16 million customers in markets nationwide, operates on the TDMA (ANSI-136) air interface. The company is launching a new network based upon the GSM air interface standard, for which AT&T Wireless seeks to ensure TTY compatibility per the FCC's regulations. Please note, however, that the overwhelming majority of the company's current customer base is supported by the TDMA network.

Network Infrastructure Software Development

TDMA Network: AT&T Wireless has received the following information regarding the status of TDMA (ANSI-136) IS-823A software development:

Ericsson: Ericsson is completing integration of IS-823A support as a correction to Version 7 ANSI, which should be available to our lab for testing in Q4, 2001

Nortel: Nortel has integrated IS-823A support as a "prep" release in MTX10

GSM Network: AT&T Wireless has received the following information regarding the status of TTY-capable GSM network software and hardware:

Ericsson will support TTY through a separate network element, known as the CTM node. This node will convert CTM (Cellular Text Modem, as defined by 3GPP TS 26.226 and related standards) signals from the air interface to Baudot, and vice-versa. The CTM node should be available for lab testing in Q4, 2001

Handset Development and Testing Plans

TDMA Handsets: AT&T Wireless has obtained information from three TDMA (ANSI-136) handset vendors concerning the status of their TIA/EIA IS-823 development and testing efforts. The information obtained from each is summarized below:

Ericsson: Ericsson reports that they are planning to support IS-823A on a handset that should be available to our lab in Q4, 2001

Motorola: Motorola reports that they are planning to support IS-823A on a handset that should be available to our lab in Q4, 2001

Nokia: Nokia reports that they are planning to support IS-823A on a handset that should be available to our lab in Q4, 2001

GSM Handsets: AT&T Wireless has obtained information from three GSM handset vendors concerning the status of their CTM (as defined by 3GPP TS 26.226 and related standards) development and testing efforts. The information obtained from each is summarized below:

Ericsson: Ericsson reports that they are planning to support CTM on a handset that should be available to our lab in Q4, 2001

Motorola: Motorola reports that they are planning to support CTM on a handset that should be available to our lab in Q4, 2001

Nokia: Nokia reports that they are planning to support CTM on a handset that should be available to our lab in Q1, 2002

Beta and Lab Testing

AT&T Wireless has in place a full integration lab for Ericsson, Lucent, and Nortel TDMA infrastructure equipment. As of the date of this report, TTY software for Lucent R17.0 and Nortel MTX-10 (both of which support IS-823A) has been loaded into test switches within the AT&T Wireless test lab for regression testing and preliminary TTY feature testing. TTY software from Ericsson will be loaded into its test switches as releases become available. In all cases, TTY-compatible switch software will be thoroughly tested in the AT&T Wireless lab before being released to a FOA (First Office Application) market.

Release and General Availability to Carriers of Software

TDMA Network: AT&T Wireless has obtained information from all three of our TDMA (ANSI-136) infrastructure vendors concerning the release of their TIA/EIA IS-823A software for general availability. The information obtained from each is summarized below:

Ericsson: Ericsson's support of IS-823A as a correction to Version 7 ANSI should be generally available as of Q4, 2001

Lucent: Lucent has integrated IS-823A support into 5ESS software release 5E15.1 BWM01-0008, and it became Generally Available in Q3, 2001

Nortel: Nortel supports IS-823A in MTX10. MTX10 will be GA in Q4, 2001 but the General Availability date of the TTY/TDD feature is still to be determined

GSM Network: AT&T Wireless has received the following information regarding the general availability of TTY-capable GSM network equipment:

Ericsson's CTM node should be generally available in Q1, 2002

Availability to Carriers of Full Acceptance Test Units

TDMA Handsets: AT&T Wireless has obtained information from four TDMA (ANSI-136) handset vendors concerning the general availability (GA) of TTY-compatible handsets. The information obtained from each is summarized below:

Ericsson: Ericsson reports that they are planning to have an IS-823 handset available for GA in Q1, 2002

Motorola: Motorola reports that they are planning to have an IS-823 handset available for GA in Q1, 2002

Nokia: Nokia reports that they are planning to have an IS-823 handset available for GA in Q1, 2002

Panasonic: Two Panasonic TTY-compatible handsets were accepted by AT&T Wireless for commercial availability in Q3, 2001

GSM Handsets: AT&T Wireless has obtained information from three GSM handset vendors concerning the general availability (GA) of CTM-capable handsets (as defined by 3GPP TS 26.226 and related standards). The information obtained from each vendor is summarized below:

Ericsson: Ericsson reports that they are planning to have a handset supporting CTM available for GA in Q1, 2002

Motorola: Motorola reports that they are planning to have a handset supporting CTM available for GA in Q1, 2002

Nokia: Nokia reports that they are planning to have a handset supporting CTM available for GA in Q2, 2002

Carrier Testing Activities, Including Field Testing and Consumer End-to-End Testing

Lucent TTY FOA

AT&T Wireless conducted a FOA (First Office Application) of TTY software in a production TDMA system during early July, 2001. This FOA took place in west suburban Chicago, utilizing Lucent infrastructure. The purpose of this FOA was to validate proper operation of the IS-823A algorithm under field conditions. Performance evaluation consisted of the transmission and reception of both plain- and random-text scripts, with independent measurements on the uplink and downlink . "Streaming" text, combined with the Lober & Walsh scoring application, was used to analyze and quantify TTY performance. Test files were collected from a number of mobile to landline and mobile to mobile calls. Propagation conditions included stationary mobile devices, slow-moving mobiles, and rapidly moving (freeway speed) mobiles. Under the majority of stationary test conditions, we found that a TCER of less than 1% was achievable on both the uplink and downlink. During mobile conditions, we found that a TCER of less than 2% was possible in the uplink and downlink during the majority of test cases, with several instances of TCER at or below 1%. However, we also found that some slow-speed drive areas and some mobile to mobile calls resulted in a much higher than expected downlink TCER (2-4%). Some of these instances of higher than expected TCER may be attributable to localized downlink interference. In general, almost all data collected using streaming text resulted in better performance in the uplink than the downlink.

Subsequent to the official FOA in July, an AT&T Wireless employee who is hearing-impaired has been utilizing TTY from an Ameriphone Q90 and a Panasonic mobile in the suburban Chicago area on a regular basis, looking for any unusual operation.

Nortel Lab Test Results

In July, AT&T Wireless performed preliminary TTY testing in its Redmond, WA labs, using Nortel network equipment and Panasonic TTY handsets. "Streaming" text, combined with the Lober & Walsh scoring application, was used to analyze and quantify TTY performance. Our initial test results indicate that the performance of the Nortel IS-823A TTY software is very good, even in simulated RF channels with a very low signal to noise ratio. We found TTY character loss due to handoffs between 1900 MHz and 850 MHz cells to be minimal, typically in the range of one to three characters. TTY calls were also successfully handed off between digital and analog channels and from analog back to digital. Two to three characters were typically lost during a digital to analog handoff, an analog to digital handoff typically resulted in a loss of two to four characters. Digital handoffs between the Nortel and the Lucent switches resulted in a typical character loss of two to three characters, and character loss during maintenance functions (e.g. disabling a radio for maintenance resulting in an intra-cell handoff) typically resulted in the loss of only one or two characters.

One interesting aspect of our testing involved measurement of TCER on an analog channel. During such operation, we found that the TCER, even on a nearly perfect RF channel, was in the 4% range. During

digital operation, almost all calls displayed a TCER of well under 1% for streaming-data random character sets. The vast majority of digital calls displayed a TCER in the uplink and the downlink of close to 0%. This performance was obtained with calls made from the mobile to the landline and from mobile to mobile.

ATIS Incubator TTY Test Effort

AT&T Wireless has in place a full integration lab for Ericsson, Lucent, and Nortel TDMA infrastructure equipment. Although the availability of this infrastructure equipment in the lab is invaluable, the observed performance of TTY under lab conditions is not necessarily a good indication of TTY performance under real-world field conditions. Consequently, in addition to the Lucent FOA conducted in early July, AT&T Wireless also hosted an industry-wide field test effort in conjunction with the ATIS TTSI (TTY Technology Standards Incubator). This TTY field test took place during the week of 10 September in the west Chicago suburb of Lisle, IL, using the Lucent TDMA network operated by AT&T Wireless and the analog network operated by Cingular Wireless. Test cases included stationary tests (minimal RF fading), slow-moving mobile TTY tests, stationary and mobile analog TTY performance testing, and numerous benchmarking tests to verify the basic performance of TTY devices when communicating with one another directly (no airlink or PSTN). All tests were executed using Gallaudet's TTY Tools V1.0 or 1.1 in conjunction with either the fast or slow typist scripts.

In general, TTY performance when using Gallaudet's "fast typist" script was consistent with that noted by AT&T Wireless during previous lab and FOA testing when utilizing "streaming" text, with the exception that the downlink was typically better than the uplink. Results with the Gallaudet "slow typist" script were slightly worse than expected, with measured TCER in the 2% range. Further investigation of the disparity between these two scripts, as well as the reversal in uplink and downlink performance, will be required. The results of this industry-wide test effort have been compiled in a database maintained by ATIS.

In an effort to help facilitate future industry-wide testing, AT&T Wireless contributed a generic ANSI-136/IS-95 test plan to the ATIS TTSI Incubator. This test plan addresses the key aspects of TTY evaluation under field conditions, although it could be adapted for use in the lab. In addition to specifying test cases, the document includes step-by-step procedures and references to standardized testbed configurations. The inclusion of these procedures and references is intended to assure consistent test results.

Retail Availability of Necessary Consumer Equipment

As noted earlier in this report, two Panasonic TDMA TTY-compatible handsets (models EB-TX310 and EB-TX320) were accepted by AT&T Wireless during Q3, 2001. Because of the many variables present at this time, AT&T Wireless cannot provide more specific information concerning retail availability of the Panasonic handsets or any other consumer equipment.

Kentucky RSA 3, Kentucky RSA 4 Cellular General Partnership
Cumberland Cellular Partnership
d/b/a Bluegrass Cellular Inc.
TTY Report
Third Quarter 2001

Background

Bluegrass Cellular uses AMPS/TDMA (IS-136) technology.
Infrastructure vendor is Nortel
Phone manufactures include Nokia, Motorola, Ericsson.

Status

Bluegrass Cellular is waiting on solutions to be made available by the handset and infrastructure vendors. The infrastructure vendor has stated they will have a solution available to carriers by late fourth quarter to early first quarter 2002. The solution will be made available in software release MTX10.

Phone manufactures have also stated basically the same with possibility of a late fourth quarter 2001 release.

Until the equipment/software is available and dates are more precise, Bluegrass Cellular is unable to give timelines and procedures for testing, and consumer availability.

Bluegrass Cellular is actively working with both its vendors and the TTY Forum to ensure consumer availability as quickly as possible.

TTY/911 for **TDMA** Systems
4-10-01 Version

Background:

The TDMA solution, authored by Lucent, has had many suggested algorithm code changes from the author. The standard committee for the TDMA solution voted to change the standard in April, 2001. Nortel Networks has completed development of a solution that complies with the IS-823 & EIA 136-410 standards. Lab testing of the solution has identified some problems with the test handset from Panasonic. Nortel Networks has not had time to fully evaluate the impact of new TDMA algorithms developed by Lucent, relating to new standards IS-823 & EIA 136-410, approved in April, 2001. It is unclear how much of the new Lucent code can be included in the MTX-10 release. Nortel will incorporate important TDMA code changes in MTX-10. Lucent has identified to Nortel Networks that some critical TDMA code changes must be included to assure the desired functionality. Interoperability issues may arise if different manufactures implement different portions of the Lucent code included in products delivered to carriers by December 31, 2001. Nortel is currently evaluating the new code and the impact on compatibility. Nortel Networks will support new standards in future software releases, but it may not be possible to include all the Lucent suggested changes in MTX-10.

Standards & FCC Requirement
IS 823 and EIA 136-410 are the approved standards as of April 2001.

The FCC deadline is for carriers to acquire solution hardware and software by December 31, 2001, and to offer service by June 30, 2002.

The FCC requires carriers to file quarterly status reports regarding the carrier's implementation status to support TTY/911 calls over their digital systems. While carriers can directly file reports with the FCC, the FCC rules ("Fourth R & O") permit carriers to report through ATIS (Alliance for Telecommunications Industry Solutions). The next quarterly report is due April 15, 2001, however as the 15th is a Sunday, reports are actually due by April 16, 2001.

Nortel Network Solution Set
The Nortel Network software solution is in release MTX-10, scheduled for general availability week 44, 2001.

Development and Testing
Lab testing has not identified problems in the Nortel Network solution, though some problems were observed in the test handset. Lack of availability of TDMA test handsets prevented testing of a wider range of handsets.

Product Time Line

MTX-10, scheduled for general availability week 44, 2001, supporting code for the IS-823 & EIA 136-410 standards. The "important" TDMA solution code recently provided by Lucent will be included in MTX-10.

Issues and Concerns

- The changes to TDMA TTY/911 code and the April 2001 standard change has created much difficulty to design solutions to a "moving target".
- The FCC's date for carriers to acquire TTY/911 equipment and software is December 31, 2001; a standard change was in April 2001. There is not sufficient time between April and December to fully evaluate all changes, and incorporate all proposed changes in software that customers will have in December 2001.
- Some proposed changes are more important than others. Manufacturers can incorporate important changes without incorporating all. It is not known how different equipment using different mixes of equipment will interoperate
- Nortel Networks believes standards must be "locked down" for equipment developers to design to a common target for initial equipment deployment. Future changes in initial equipment standards should provide time developing a stable and fixed second round design target
- Industry solutions only support Baudette 45.5 TTY transmissions, propriety TTY transmissions, and European Baudot 50 is not supported.

According to Lucent, manufacturers must incorporate the important parts of the recent TDMA solution code distributed by Lucent, or the solution will not work.

Caprock Cellular Limited Partnership

Progress of TTY-Digital Deployment Solutions
CC Docket No. 94-102
3rd Quarterly Report
September 30, 2001

#1   Network infrastructure software development:

Caprock Cellular utilizes Nortel Networks equipment to provide TDMA digital services in Texas RSA 4. A report from Nortel Networks states that development of software is complete, and product tests have been completed as well. Testing was limited to Panasonic prototype handset, as other equipment was not available during the test.

#2   Handset development and testing plans

Caprock Cellular must rely on handset vendors to develop the required handsets. When handsets are available testing can be performed with area PSAPs to insure compatibility.

#3   Beta testing and lab testing

Caprock Cellular must rely on Nortel Networks and handset vendors for initial conformance testing.

#4   Release and general availability to carriers of network infrastructure software

Nortel Networks has stated that the required software load, MTX10, will be generally available week 44 of 2001. The exact date of deployment of this software load is not known at this time, but is tentatively scheduled for the 3rd Quarter of 2002.

#5   Availability to carriers to full acceptance test units

Nortel Networks plans to test and confirm the solution performance during the six-month extension allowed for this purpose.

Caprock Cellular Limited Partnership
Progress of TTY-Digital Deployment Solutions
CC Docket No. 94-102 - 2nd Quarterly Report

#6   Efforts toward achieving digital wireless solution capability with enhanced TTY devices.

The solution provided by the MTX10 software load addresses Baudot type messages only. Other capabilities may be included later, after standards are adopted.

#7   Carrier coordination of testing with PSAP

See response to item #2 above.

#8   Carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests.

Caprock Cellular cannot begin testing activities until the correct software load is installed in the switch and handsets are generally available.

#9   Retail availability of necessary consumer equipment

At this time it is unknown when handsets will be available.

#10   Geographic scope of network infrastructure deployment

According to Nortel Networks, the MTX10 software is the only requirement for implementation. The mobile switch, if currently at MTX09, nor the cellsite equipment will require hardware changes. (Caprock Cellular does not own the mobile switch, Plateau Telecommunications provides switching for Caprock's cellsites. Due to this fact Caprock cannot control implementation dates for the required software.)

North Carolina RSA 3 Cellular Telephone Company
d/b/a Carolina West Wireless
TTY Report
Third Quarter 2001

Background

Carolina West Wireless uses TDMA technology
Infrastructure vendor is Nortel
Phone manufactures include Nokia, Motorola, Ericsson and NEC

Status

There is no change from the second quarter report concerning the availability of handset and infrastructure solutions from the vendors. The infrastructure vendor continues to set the release of the MTX10 software for late December 2001 or early January 2002. The tentative schedule to deploy the MTX10 software, based on this release, is the first quarter of 2002.

Phone manufactures continue to set possible availability of equipment for late fourth quarter 2001.

Carolina West Wireless is unable to predict precise dates for testing and consumer availability until the software and equipment are made available.

Carolina West Wireless continues to actively work with its vendors and the TTY Forum to ensure TTY availability as quickly as possible.

October 10, 2001

Magalie Roman Salas
Office of the Secretary
FCC
445 12th Street S.W.
Washington, D.C. 20554

Re: FCC Docket No. 94-102

Dear Ms. Salas:

The following is submitted in satisfaction of the quarterly reporting requirements for 911 TTY transmissions.

1) Network Infrastructure Software Development: Currently under exploration   with our network equipment vendor.
2) Handset Development and Testing Plans: Currently under exploration with handset suppliers.
3) Beta testing and Lab testing: Not currently scheduled.
4) Release and General Availability to Carriers of network Infrastructure Software: Currently under exploration with our network equipment vendor.
5) Availability of full acceptance Test units: Currently under exploration with handset suppliers and network vendor.
6) Current efforts toward achieving digital wireless solution compatibility with enhanced TTY devices: Currently under exploration with handset suppliers and network vendor.
7) Carrier coordination of testing with PSAP: No requests from the PSAPs have been received.
8) Full Testing: Not currently scheduled. Awaiting information from handset and network vendors.
9) Retail availability of equipment: Not currently available. Awaiting information from handset vendors.
10) Coverage Area: Eleven counties in East Central Illinois; IL 7 & 3 northern counties of IL 9.

Sincerely,

Steve Bragorgos
Operations Manager
Cellular Properties, Inc.

September 17, 2001

To: TTY Forum

From: Susan Palmer and Ken Evans

<u>TTY Forum #19 Report</u>
<u>Cingular Wireless LLC</u>

<u>Overview</u>

Cingular Wireless LLC (Cingular) is satisfied with the progress that has been made since the last Forum. Communications amongst all parties continues to improve.
We have conducted testing in the TDMA environment on the proposed solutions for the technical problems highlighted in our July Report. Using total character error rate (TCER) as a measure, the results to date have been favorable. Our manufacturers have indicated delivery of handsets will be timely, however, it should be noted that we had difficulty obtaining TTY ready handsets for testing purposes.

Cingular has conducted testing with three different handset vendors. Handset performance varies from vendor to vendor. However, all handsets tested to date have yielded acceptable results. Cingular is concerned that any delays in the availability of TTY compatible handsets could frustrate customers and delay implementation of a viable TTY solution.

At this point, we do not have the equipment necessary for testing GSM technology in our labs or network. We have been assured that equipment will be delivered to us by early November. The lack of GSM testing remains a concern. It is possible that unforeseen technical issues could exist. However, Cingular is committed to work together with manufacturers and consumers to resolve any technical issues.

In addition to technical issues, to have effective TTY access, supporting documentation and information regarding handset and handset connectivity must be given to service providers in time to develop appropriate customer care and sales support. Methods and procedures must be developed to ensure that TTY compatible handsets and cables are available to customers in a timely fashion. If it appears that a low volume of units will be available initially, manufacturers, service providers and representatives of the Deaf community should work proactively to address this issue.

TDMA

Cingular Wireless has conducted individual and joint testing (with TTSI) of the No Gain solution in Ericsson and Lucent switches. The results have yielded a total character error rate that is similar to results obtained in analog environments. Additional testing is needed to insure various mobile scenarios yield acceptable results.

Cingular is in the process of finalizing an implementation schedule that will result in first office application (FOA) and some commercial deployments prior to the end of the year. However, handset availability may limit testing in our FOA sites.

GSM

Cingular plans to begin testing GSM infrastructure software for the CTM solution in mid November. The same concerns described regarding the availability of handsets for infrastructure testing in the TDMA environment are applicable for GSM.

Conclusion

Cingular Wireless notes that progress was made last quarter toward resolving many of the technical issues highlighted in the July Report. However, there might still be technical issues that have not been diagnosed, particularly in the GSM environment, because technologies have not been fully tested. Handset availability continues to delay this process and availability of handsets will be a critical part of providing TTY access to consumers. The cooperation noted this quarter must continue in order to meet the June 2002 deadline.

Corr Wireless Communications, L.L.C.

Corr Wireless Communications, L.L.C. (Corr Wireless) is working with vendors to insure compliance with the FCC implementation deadline.

Dobson Cellular Systems

October 11, 2001

Dobson Cellular Systems (DCS)/ American Cellular Corporation (ACC)
TTY Report – 3rd QTR

Network Infrastructure Software Development

DCS/ACC utilizes TDMA infrastructure from Lucent and Nortel. DCS/ACC relies on these two vendors to complete software development and upgrades. Lucent is ready with it's ECP Release 17 and Nortel will be ready with MTX-10 in Nov. 2001.

Handset Development and Testing Plans

DCS/ACC relies on its handset vendors for the development and testing of TTY capable handsets. Panasonic has replied that two phones, the ProMax and the DuraMax wireless phones do not support TTY, but the Atlas CE and CS models do. Ericsson has replied to DCS that their R300D has successfully completed a full duplex transmission of TTY characters with no errors. Network testing still has to be completed.

Beta Testing and Lab Testing

DCS does not have a lab for testing. Once the TTY software is deployed from Lucent and Nortel we can begin field-testing.

Release and General Availability to Carriers of Network Software

See: Network Infrastructure Software Development above.

Availability to Carriers of Full Acceptance Test Units

DCS/ACC is waiting on commitments from our handset vendors.

Carrier Coordination of Testing with PSAP

DSC/ACC will conduct TTY testing with PSAP's that request. We will also inquire to PSAP's that we have implemented Phase I E911 on their availability to test with us, once the software and handsets become available.

Carrier Testing Activities, Including Field Testing and Consumer End-to-End Testing

DCS/ACC will conduct consumer testing end-to-end once handsets and software become available.

Retail Availability of Necessary Consumer Equipment

Availability is still uncertain. We hope to have a better day and time on the next report.

Geographic Scope of Network Development

Although there can be complications with the availability of handsets and software testing, DCS/ACC remains committed to the June 30, 2002 deadline.

Sincerely,
Sean O'Hara
Special Project Manager
Dobson Cellular Systems

Sony Ericsson Mobile Communications and Ericsson Inc.
TTY Forum #19 Report
October 10, 2001

This report details the verbal presentation provided by Sony Ericsson and Ericsson Inc (hereafter collectively referred to as "Sony Ericsson") at the September 25th, 2001 TTY Forum 19. The attached report identifies standards status, project status, technical design issues, test status, delivery planning information and contact information.

Sony Ericsson has completed the initial designs that incorporate TTY technology within its products, and many of those products have been released for development testing. In general, the technical feasibility to transport TTY across the digital cellular systems has been proven by initial product testing. Cooperative industry TTY testing is in process. Technical flaws and system integration issues continue to be identified in the development and test processes. The majority of the flaws identified have led to design changes. The process of testing involves a tremendous amount of equipment, planning, documentation, and cooperation among the manufacturers, carriers, 911 PSAP facilities, standards organizations, and governing bodies. Sony Ericsson also continues to monitor Standards Organizations, the ATIS Incubator, and the test results to identify problems associated with operability and interoperability of the TTY systems.

1) <u>Network Infrastructure Development</u>:

TDMA Status:

The development of code for the TDMA network infrastructures was completed on July 31, 2001. Development software testing is complete for TRAB2 products. Regression testing for TRAB3 products is currently being conducted at the Montreal and Raleigh facilities. Lab tests indicate TDMA network products are generating positive test results. Sony Ericsson has implemented the IS-823A approved-balloted versions of standard. In addition, Sony Ericsson has implemented the proposed IS-823B fixes for self echo, false frames, 50 baud errors, and leaky voice frames. Sony Ericsson has not implemented squelch on the network TTY detector. Critical changes to the IS-823 standard for self-echo within the network were addressed in a patch to TRAB 2 products on August 12, 2001. This fix was tested and continued to exhibit problems with certain Mobile and TTY terminal product combinations. Identification of a problem with IS-641 filter has since solved this problem. This problem has been identified to the ATIS Incubator for resolution with the standards bodies. Final regression tests and delivery of redesign of TRAB 3 software was released on September 17th, 2001. Early results of the TRAB 3 test cases are encouraging. The majority of development test cases are complete for TDMA, and the "final development release" is expected shortly.

TDMA Plans:

The TDMA FOA is scheduled for November 01- 12, 2001.

GSM Status:

The development code and products for the CTM circuit pooling node for the GSM network infrastructure were shipped on September 24th, 2001 to Richardson Texas. The CTM Node product includes both hardware and software components, that when combined provide the CTM function for GSM. There have been changes to the technical standards for TTY detection. The current design incorporates TR23.231 bit exact changes dated September 03, 2001, which change the TTY detector from a 5 bit to a 4 bit length. The design also incorporates the July 21 standards changes from July 06 draft documents which move the bearer bit from octet 3a bit 5 to bit 6. These changes were incorporated in the initial development release of the code. The current implementation is to the approved ballot-accepted versions of the 3GPP standards in all other respects. The development hardware and software were delivered to the Richardson test facility on October 01, 2001.

GSM Plans:
The second CTM Node is scheduled to arrive October 10th, 2001. Algorithm verification is scheduled to complete October 15th, 2001. The development code is scheduled to complete by October 31, 2001. The development code release to carrier infrastructure for testing will be November 01, 2001. The development verification testing is scheduled to complete on November 15th, 2001. The system verification test release is expected to be released on November 16th 2001. The system FOS is scheduled for November 16th, 2001.

C DMA Status:
The development of code for the CDMA network infrastructures of the TTY/TTD vocoder enhancement is currently in progress with active simulation and DSP code development. First simulation testing started in September followed by emulator testing and integration testing. Deliveries of development releases of the enhanced vocoder will be tested in Sony Ericsson labs. The delivery of carrier verification test level of product is scheduled to be available in mid-December.

CDMA Plans:
Various lab testing are planned according to the development plan. System level testing is expected to be completed by December 31. System verification test release software will be released to carriers in January, 2001.

2) Handset Development and Testing Plans;
Sony Ericsson terminal products have progressed through the "development stage" and are entering the final stages of "product test stage". The build plan and development testing are complete for all product technologies. Test data is now being generated for CDMA, TDMA, and GSM products. Handsets testing for ATIS test events are in place, and are being supported by both Sony Ericsson and Ericsson. The release of validation products to outside organizations is ongoing.

TDMA Status
TDMA Handsets were delayed due to the significant problems encountered with the TTY standards, the development integration process, and test failures with system elements. Prototype testing revealed problems with the standard, and with TTY devices. Fixes have been incorporated for self-echo, volume level, IS-641 filtering problem, and 50-baud errors. Testing of

these critical fixes provided a 0.6-% maximum (0.25% average) character error rate (CER) when tested with various TTY devices, and configurations, in a static location. Error rates of less than 0.5-% were measured with a –95 dBm RSSI level. Development code was released on September 21, 2001 with critical fixes incorporated in the design. Development tests for TDMA are ongoing. A release development build occurred on September 25th, 2001 for carrier development product testing. Carrier development test units are expected to be available on October 31, 2001.

TDMA Plans

Carrier test units with the final user interface is expected to be available on December 03, 2001. Volume availability is expected March 31, 2001

GSM Status

GSM handsets were delayed due to standards activities not completing until July 21, 2001. Minor changes to standards have had minimal impact to the GSM development schedule. Software development is complete for terminal and CTM box. Handset products in development testing revealed problems with the standard, and with TTY devices. Fixes for TTY detector bit lengths were implemented. TSB 121 level interface testing also required fixes to the TTY product.   Development code released September 09, 2001. Carrier Test units availability release September 12th, 2001. GSM development testing provided a 0.5-% maximum (0.18% average) character error rate (CER) when tested for various TTY devices, and configurations, in a static configuration. Error rates of less than 1-% were measured with a –105 dBm RSSI level. Carrier development test units are expected to be available by October 12th, 2001.

GSM Plans

Carrier test units with the final user interface are expected to be available on December 31, 2001. Volume availability is expected on February 20, 2001.

CDMA Status

CDMA Handsets encountered problems in the development integration process with TTY devices. Final handset products are in development test. Prototype testing revealed problems with the standard, and with TTY devices. Fixes for Self-Echo have been implemented. CDMA development testing provided a 0.18-% maximum error rate when tested for various TTY devices, and configurations, in a static configuration. A release development build occurred on September 12th, 2001 for testing on Lucent Infrastructure. Carrier development test units are available. The test was delayed due to the events in September. Final handset user interface for Carrier testing is being finalized.

CDMA Plans

Carrier test units to customer level are expected to be available on November 15, 2001. Volume availability is expected by December 03, 2001.

3) Beta Testing and Lab Testing;

TDMA Infrastructure Beta Testing and Lab Testing

Beta Testing of TDMA software was completed for TRAB 2 software on October 05, 2001. Beta Testing of TDMA software for TRAB 3 is under way and scheduled to complete by October 17th. TDMA Network Infrastructure was tested at the ATIS Incubator Test event September 10 – 14th in Lisle IL. The test for TRAB 2 software produced very favorable test results. While not all tests were completed, those that were, demonstrated a fully functional technology, with a usable error rate.

GSM Infrastructure Beta Testing and Lab Testing
Testing of the initial hardware and software has started. The initial functional testing occurred during August, and performed satisfactorily. The CTM code completed cursory development tests, and was within the 1-% error rate limits. Initial development functional tests were completed on September 24th, 2001. Development testing scheduled for completion November 15th 2001.

CDMA Infrastructure Beta Testing and Lab Testing
CDMA simulation testing is currently underway. CDMA test planning and test case generation is in process.

4)   Release and General Availability to Carriers of Network Infrastructure Software;

TDMA Infrastructure GA December 05, 2001
GSM System generally available (GA) with GSM R9.0 (Starting Rollout January 15th, 2002)
CDMA Generally Available with system Release 8.6 (Starting Rollout February 28, 2002)

5)   Availability to Carriers of Full Acceptance Test Units;

- *TDMA Handsets December 03, 2001*
- *GSM Handsets and CTM box December 31, 2001*
- *CDMA Handsets November 15, 2001.*
- *TDMA Network Infrastructure October 22, 2001*
- *GSM Network Infrastructure November 16, 2001*
- *CDMA Network Infrastructure dates January 2, 2002.*

6)   Efforts Toward Achieving Digital Wireless Solution Compatibility with Enhanced TTY Devices.

Sony Ericsson continues to work very closely with all manufacturers and carriers on the TTY compatibility mandate. Sony Ericsson has taken a leadership position in the debug, test, and isolation of potential customer and user anomalies that have resulted in changes to the product standards and implementation techniques. These include virtual TTY detector implementations for acoustic echo canceller implementations, TTY turbo code anomalies, leaky voice frames, and the IS-641 filter issue. Sony Ericsson will continue to work toward the trouble free first pass implementation of TTY technology for all the digital wireless solution systems.

7)   Testing and Deployment Activities

Sony Ericsson is working with the ATIS Incubator, which is taking a leadership position in the test procedures, plans, testing and coordinating carrier testing of TTY technology. The first industry test event tested TDMA Infrastructure for Lucent, and Ericsson, and handset products from multiple manufacturers, including Sony Ericsson. The tests demonstrated the operation, static operation, operation with various TTY devices, calling configurations of mobile to mobile, mobile to landline, and mobile to PSAP. Driving and AMPS tests were also conducted. The tests clearly went along way to validate the technology in an actual operational setting.

- Sony Ericsson has developed tests to support the required testing within the PSAP structure. Sony Ericsson is working with the ATIS Incubator to refine this test process, and participate in generating test results.

- Manufacturers will validate self-operation and compliance under the FCC mandate.

- Additional testing with PSTN to cell, and cell to cell, operation with multiple types of TTY devices, user interface testing, and validation of FCC mandated operations is expected to take place within the ATIS Incubator and in Customer FOA test events.

8) Risks:
At the TTY Forum 19 several manufacturers pointed out risks and concerns with respect to meeting the compliance requirements by the FCC. Currently, Sony Ericsson is working several issues through the ATIS Incubator process. Several of these issues have been in the resolution process since TTY Forum meeting 18. These items include IS-641 filter performance, and leaky voice frame performance of TTY detectors.

The IS-641 filter performance is at the earliest stage of evaluation. Studies of the test data suggest the IS-832 transport behavior is influenced by the Ultratec Compact 1600 TTY unit. Complete assessment and early resolution of this concern is needed to lower the risk posed by these findings. Sony Ericsson is monitoring the results of test data of multiple TTY devices with the TTY standards. Sony Ericsson is currently evaluating and implementing proposed changes for 50 Baud problems with TDMA and CDMA signaling, leaky voice frames of TDMA signaling, CTM TTY detector bit length, TTY detector squelch limits, Ameriphone Q.90 and Ultratec Compact 500 output impedance, and false frame detection. Sony Ericsson is verifying fixes for self-echo, echo suppressor integration, IS-641 filter fixes, and echo suppressor errors in TTY detection.

Critical Work Status:
Several "critical work items" have been in process since the TTY Forum Meeting 18. These items include user intervention, the "TTY mode switch", and recent changes to the TTY standards.

The acceptance of user intervention, and the TTY switch, in the user interface, has alleviated a significant concern for the wireless industry. At TTY Forum 18, additional user intervention guidelines were proposed with respect to the TTY mode switch. Several carriers have provided functional improvements in TTY control functions. Sony Ericsson has defined a user interface to adhere to these evolving guidelines and is preparing product implementations in each

technology, for carrier and user evaluation. These user interface features will be made available in the carrier approval release versions of the mobile products.

Sony Ericsson continues to develop product changes to react to the changes in TTY ballot standards, test results, and ATIS Incubator issues. Currently there are many reported behavior anomalies in TTY signaling that have required design changes. Although it is evident that additional changes to the code are required, it has been demonstrated that the majority of test cases are passing from repairing the high priority items identified in the development test plans. Products are in the process of releasing these repairs to critical functions. It is expected that these items should not significantly hinder the industry testing, and interoperability testing that is now underway. It may be necessary to make additional changes within the carrier approval test products to incorporate the remainder of the identified problems. For products that have completed the TTY development process a significant schedule risk is incurred if any additional high priority problems are identified. Additionally, each change to the TTY standards and proposed implementation imposes a great risk to the product schedule.

Please feel free to contact either Matt Kaltenbach or Steve Coston if you have any question regarding this report, or wish to contact test or product interfaces. Please contact your local customer interface for product sales and marketing information.

Farmers Cellular Telephone Inc.
TTY Report

Farmers Cellular network consist of only one Nortel switch. We offer analog service as well as TDMA digital. Farmers Cellular has purchased the latest software upgrade from Nortel. We remain committed to meeting the FCC's tentative mandate to provide E911 TTY access to our network.. The software to support IS-823 has been delayed, but Nortel's newly-scheduled release date should still allow compliance. Nortel will not support 50-baud TTY for their first release.

Our handset vendor status: Ericsson is on schedule. Motorola has not given an update, and Nokia is on schedule.

Farmers Cellular Telephone, Inc.
TTY Report
October 9, 2001

- Network infrastructure software/hardware development and testing

   Farmers Cellular Telephone, Inc.'s ("Farmers Cellular's") network consists of only one Nortel switch. We offer analog service as well as TDMA digital. Farmers Cellular has purchased the latest software upgrade from Nortel. Nortel Networks' development is complete, and product tests have been completed as well. Nortel tested with Panasonic prototypes. (Other handset vendors were not available during Nortel's NBSS10.1 test cycle).

- Handset development and testing plans

   Farmers Cellular handset vendor status: Ericsson is on schedule. Motorola has not given an update, and Nokia is on schedule.

- Schedule for deployment of the software/hardware in the Farmers Cellular switches

   The minimum baseline software requirement for this feature to be deployed in Farmers Cellular switches is MTX10 or higher. Software is scheduled to be available Week 44 and will be scheduled for deployment on specific Farmers Cellular switches on a market-by-market basis.

- Beta testing and lab testing

   Turbocode/ HiSpeed is a proprietary feature on Ultratec/Ameriphone TTY device and is not supported by TDMA standards. If TDMA standards are enhanced to support these devices, Nortel will support this in a future release. However, standards are designed to avoid supporting propriety methods and there is no known effort to standardize the propriety features.

- Release and general availability to carriers of network infrastructure software

   Under Nortel's recommendation, Farmers Cellular will engage the chosen TDMA TTY handset vendor during network testing to do interoperability testing with the Nortel Networks solution.

- Plans to test with the Public Safety Community (PSAP's)

   Farmers Cellular will schedule this testing with the PSAP centers during its network testing. Farmers Cellular will work with Nortel to identify PSAPs that would be willing to test an end-to-end solution.

- Carrier Testing activities

    Testing will begin upon receipt of software.

- Retail Availability

    Farmers Cellular is dependent upon the availability of handsets from vendors.

- Geographic scope of network infrastructure deployment

    Farmers Cellular will test the four PSAPs in our geographic area when the software is available.

    Farmers Cellular remains committed to meeting the FCC's tentative mandate to provide E911 TTY access to our network. The software to support IS-823 has been delayed, but Nortel's newly-scheduled release date should still allow compliance. Nortel will not support 50-baud TTY for their first release.

Midwest Wireless Holdings L.L.C
TTY Status Report
October 8, 2001

Background

Midwest Wireless Holdings L.L.C. is a rural carrier that operates TDMA digital cellular service in its Minnesota, Iowa and Wisconsin markets. Due to the complexity of this issue, Midwest must rely on its switching vendor, Nortel Networks, to provide the necessary switch software, and the capabilities of our two major handset providers, Nokia and Motorola, in order for our company to meet compliance deadlines.

Status

Nortel has announced the general release of MTX10 for November 30, 2001. MTX10 is the base software load that will be 12/31/01 software compliant. Midwest Wireless does not plan to install MTX10 until late 1st or early 2nd qtr. 2002. This will change our earlier prediction of meeting the 12/31/01 software compliance deadline, but should not change our expectations of meeting the June 30, 2002 deployment date.

Respectfully submitted
Gary Christopherson
Midwest Wireless Holdings L.L.C.

October 10, 2001

Via Electronic Mail and Federal Express

Ed Hall
The Alliance for Telecommunications Industry Solutions
1200 G Street, NW
Suite 500
Washington, DC 20005

Dear Mr. Hall:

Motorola is pleased to submit a status report related to our efforts at attaining TTY compatibility with our digital phones and infrastructure. Motorola is a domestic supplier of cellular handsets in TDMA, CDMA, GSM, and iDEN technologies. We also provide infrastructure equipment in CDMA and iDEN technologies.

We are working closely with our carrier customers to provide them with the equipment necessary to meet the Federal Communications Commission's June 30, 2002 TTY deployment deadline. At this time, we are on track to enable these carriers to meet their obligations.

The attached report is provided to the TTY Forum for its report to the Commission for the third quarter of 2001. Please contact me at the number below if you have any questions.

Regards

Alfred R. Lucas
Vice President and Director
Office of Access Excellence
Motorola
Voice: 561-739-2505
TTY: 561-730-2506

Enclosure

MOTOROLA
TTY COMPATIBILITY DEVELOPMENT STATUS REPORT
3ND Quarter 2001

Product	Standard	Status	Milestones	Progress
CDMA Handset	IS 127-3 IS 733-2	Integration & System Test	IOT: June 2001 UI: October 2001 ROM: December 2001 SA: 1Q 2002	Planning to participate in November ATIS testing with Sprint.
GSM Handset	TS 26.226 TS 26.230 TR 26.231	Integration & System Test	UI: October 2001 IOT: October 2001 ROM: December 2001 SA: 1Q 2002	Mobile to Mobile calls are functional. Optimization activities are on-going. IOT will start in October.
iDEN Handset		Beta in customer's lab	On plan	
TDMA Handset	IS 823-A IS 840-A	Integration & System Test	IOT: September 2001 UI: September 2001 ROM: October 2001 SA: 1Q 2002	Tested at AWS in Naperville, IL using Lucent Infrastructure. Tested both AMPS and TDMA.
CDMA Infrastructure	IS 127-3 IS 733-2	Ready for FOA	Field Testing: Nov 13-15, 2001	Infrastructure software in field has digital TTY support available now. Only handsets are needed to commence FOA.
iDEN Infrastructure		Beta in customer's lab	On plan	

Note: Motorola works with its carrier customers to provide them specific information related to their respective products.

Note: IOT is Inter Op Testing with RAM based parts for Character Error Rate testing
UI is User Interface testing with HCO / VCO support
ROM is the availability of ROM based phones. These should be functionally identical to a RAM phone.
SA is Ship Acceptance of production volume quantities

Al Lucas
Office of Access Excellence
Motorola
Phone: 561-739-2505
TTY: 561-739-2506

NEXTEL®

October 10, 2001

Via Electronic Mail and Federal Express
Megan Hayes
The Alliance for Telecommunications Industry Solutions
1200 G Street, NW
Suite 500
Washington, D.C. 20005

Re: Nextel Communications, Inc. Fourth Quarter 2001 Report to the TTY Forum

Dear Ms. Hayes:

Pursuant to the Fourth Report and Order of the Federal Communications Commission ("Commission") in CC Docket No. 94-102,[3] Nextel Communications, Inc. ("Nextel") hereby submits this report on the status of its efforts to attain TTY accessibility on Nextel's iDEN handsets and network. Working closely with its vendor, Motorola, Inc. ("Motorola"), Nextel is pleased to report that its TTY accessibility progress continues to move ahead in a timely manner. Pursuant to this schedule, Nextel intends to fulfill the Commission's June 30, 2002 TTY deployment deadline.

Nextel is a provider of digital Commercial Mobile Radio Services using Motorola's iDEN technology. Nextel is one of only three such iDEN providers in the United States. Thus, Nextel has worked with Motorola in the research and development of a TTY compatibility solution for the iDEN product and network. Since the Telecommunications Industry Association ("TIA") approved the Lucent solution for providing TTY accessibility on digital networks, Motorola has invested significant time and resources in creating a solution that will provide the same accessibility on iDEN networks.[4]

Motorola has completed its lab testing of the TTY-capable iDEN handset and network infrastructure. Nextel is now conducting its own lab tests on both the TTY-capable iDEN handset and TTY network infrastructure. At the same time, Nextel is conducting a First Office Application ("FOA") test of the TTY capabilities in one of its markets in California. These FOA field tests, which will likely continue through November, will include users from the hearing-impaired community who will have the opportunity to test their own TTY devices on the Nextel system. Nextel has been working with Gallaudet University to locate potential users for these tests.

Once Nextel completes its testing, assuming no significant roadblocks are uncovered during the testing process, Nextel can initiate full deployment of the TTY upgrades throughout

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[3] *In the Matter of Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Calling Systems,* Fourth Report and Order, CC Docket No. 94-102, FCC 00-436, released December 14, 2000 ("Fourth R&O").

[4] *See, e.g.,* Fourth R&O at para. 3.

its nationwide network. As Nextel has previously explained, these modifications will impact the process for encoding the voice channel on iDEN's system. Because such vocoder modifications have the potential to impact voice quality for all Nextel users, these base station controller modifications will require considerable time and attention. At this time, Nextel anticipates completing deployment by the Commission's June 30, 2002 deadline.

Nextel appreciates the opportunity to provide this report to the TTY Forum as part of the forum's quarterly TTY report to the Commission. If you have any questions about this report, please do not hesitate to contact me at 703-433-8315.

Sincerely,

Robert D. Montgomery
Senior Manager – Regulatory Technology Development

NOKIA

Nokia Status Report to TTY Forum #19 – October 2001

Nokia manufactures mobile phones for wireless technologies; AMPS, TDMA, CDMA and GSM; at both 800 and 1900MHz. Some phones are also developed with multiple technologies in an individual handset. Nokia supplies network infrastructure for GSM.

Nokia is currently developing FCC compliant TTY Compatibility in seven new phone programs with specific models having CDMA, TDMA, GSM and AMPS.

Nokia is committed to meet FCC deadlines for digital TTY according to industry standards set and agreed to.

HARDWARE SOLUTIONS:

Nokia continues to develop mobile handset products to support TTY/TDD Compatibility with TSB-121 three-pin headset functions. Other handset projects will have a built-in 2.5mm jack four-conductor "Stereo" connection in the handset body; with adapting interconnect cables to comply with TIA/EIA TSB-121.

Consumers and the TTY manufacturers must be aware that the quality of connecting cables will be crucial to the performance of this capability. Nokia is also concerned that compliance to the necessary standards is not sufficient to the successful operation of the TTY capability, vis-à-vis TSB-121.

MOBILE TERMINAL SOFTWARE SOLUTIONS:

CDMA IS-127-2 (as of July 2001)
Nokia CDMA Products are developed by Nokia's San Diego facility

Six to eight models are under development for TTY Compatibility.
    Lab Testing has occurred with Lucent and Nortel infrastructure with the acceptable results.
    Currently scheduling testing with Motorola and Ericsson infrastructure.

TDMA IS-136 / IS-823

    Five to seven models are being developed for TTY Compatibility.
    Lab testing has occurred with Nortel Infrastructure with the acceptable results.
    Lab testing for Lucent and Ericsson is expected in October.
A TDMA handset product, supporting TTY, will be available to test in Q4 2001, generally available Q1 2002

NOKIA

NOKIA Americas Standards   October 10, 2001
Submitted by:
    Chris Wallace
    V.P. Nokia Americas Standards

GSM   ATIS T1.719 and T1.718, except the TTY detector

At this point, no lab testing has been established with an infrastructure vendor.

A GSM product, supporting TTY, will be available to test in Q1 2002, generally available Q2 2002

More details will be available as these products are commercially announced

Respectfully Submitted By:
    Chris Wallace
    V.P. Nokia Americas Standards

Douglas W. Neeley   Leo Fitzsimon
Sr. Technical Standards Eng.   Government Affairs
                                                            (202) 887-0145

October 10, 2001   **CDMA TTY/TDD Regulatory FAQ/RFI**

Enclosed is information regarding Nortel Networks' plans to comply with FCC's TTY requirements for CDMA service providers.

- What is the status of TTY/TDD network infrastructure software/hardware development and testing?

  Nortel response: Nortel Networks' development and product test is based on current standards: IS-127-2 (EVRC) & IS 733-1(13K Vocoder). New revisions of these standards namely IS-127-3 (EVRC TTY) & IS-733-2 (13K TTY) have been published as of September 2001. Nortel Networks plans to support this new addendum to the standards in 2002. Operators will be able to deploy the Nortel Networks TTY solution based on the current standards IS-733-1, IS127-2 to meet the FCC deadline for implementation. Nortel Networks has completed testing using prototype mobile handsets from only a few vendors, which have shown positive results. Nortel Networks does not anticipate performance issues with any other vendor's handsets once they come available.

- What is Nortel Network's TTY/TDD plans to test and confirm solution performance including additional tests referenced in Sections 20-23 of the FCC 4th Rule and Order 12-14-2000?

  Nortel response: Regarding Section 20-23, Turbocode and HiSpeed is each a proprietary feature of TTY device vendors Ultratec and Ameriphone, respectively. Due to the code being proprietary Nortel Networks will not test or support these enhanced solutions. Standards are designed to avoid supporting proprietary methods, and Nortel Networks is not aware of any effort to standardize these proprietary features.

- What are the hardware baseline and software baseline to support CDMA TTY/TDD functionality?

  Nortel response:

Regulatory solution required	CDMA HW/SW baseline
TTY/TDD	MTX09 SW (DMS-MTX) NBSS10.1.1 SW (BSS) TTY capable handsets (3rd party)

- What software baseline must the MTX be running in order to upgrade to MTX10 and/or NBSS10.1.1?

  Nortel response: The MTX is required to be running MTX09 in order to upgrade to MTX10 and/or NBSS10.1.1. Nortel Networks has always maintained an allowance for CSP or Communication Services Platform "jumps" from MTX release to MTX release. The MTX has received significant changes due to moving to a multi-processing architecture thus the CSP layer has evolved to CSP14. It is because of this very different CSP14 layer of the MTX10 release that an MTX cannot upgrade safely from MTX08 directly to MTX10.

- What is the Network infrastructure software/hardware planned general availability dates that support the deployment of this regulatory feature?

  Nortel response: In order to comply with the FCC's December 31, 2001 requirement for TTY/TDD, Nortel Networks commits to delivering the enabling software as follows:

Software load	CDMA SW general availability
MTX09	Now Available
NBSS10.1 with MTX09	October 12, 2001
MTX10 CDMA	December 7, 2001

Nortel Networks Proprietary and Confidential

- How is the software/hardware for TTY/TTD subscribers provisioned in the network?

  Nortel response: The provisioning for TTY must be done the same way as for the voice subscribers.

- What is the schedule for deployment of the software/hardware in the network?

  Nortel response: The minimum baseline software requirements for this functionality are given above. For questions related to scheduling its deployment into a carrier's network, please contact Nortel Networks Product Deployment.

- For TTY/TDD what are the plans to work with any wireless carrier to perform end-to-end customer tests, and when will this occur?

  Nortel response: The verification process for NBSS 10.1 with the customer began in June 2001. Nortel has recommended that the operator engage their chosen CDMA TTY handset vendor during the verification process or VO process to participate in interoperability testing with the Nortel Networks solution. Nortel Networks recognizes that to date few if any handset vendors have published GA dates for TYY mobile handsets. To Nortel Networks' knowledge, as of October 10, 2001, TTY capable handsets and compatible TYY/TTD devices have not been acquired by any of our service provider VO partners. Despite this fact, Nortel Networks' will not delay the delivery of this software load to all customers planned October 12, 2001. This decision not to delay is driven by the importance of the TTY feature, and the positive results of the TTY/TTD internal testing. The general availability of this SW solution will allow a greater number of our customers to become verification partners. Nortel Networks' forecast for this specific feature's full verification is planned to occur in the mid-October and in the November time frame with two of our lead customers, respectively.
  Operators are also encouraged to request their handset vendors to test their commercial grade CDMA TTY capable handsets in Nortel's Wireless Interoperability Lab.
  All verification activities are dependent upon the availability of commercial grade CDMA TTY/TTD handsets.

- What are Nortel Network's plans to test their own or other vendor handsets with your switch solution?

  Nortel response: Nortel Networks provides only infrastructure for wireless networks. Nortel Networks does not provide mobile handsets. Even though the infrastructure software is scheduled in advance of the Dec 31, 2001 FCC requirement, commercial handset general availability dates have not been scheduled by handset vendors. Nortel Networks recommends that the operator engage its handset vendor(s) in order to respond to the FCC regarding commercially available handset.

  Operators are encouraged to request their handset vendors to test their commercial grade CDMA TTY capable handsets in Nortel's Wireless Interoperability Lab.

  Please contact Cher Bruce for scheduling TTY testing in the Nortel Networks Wireless Interoperability Lab, where testing is based on current published standards (Phone: 972-684-2299; Fax: 972-684-3881; csbruce@nortelnetworks.com)

- **Contacts:**

  Product Marketing   MTX10/NBSS10.1 SW   Kurt Raaflaub   ESN 445-2971
  Product Management   CDMA TTY/TDD   Maniam P   ESN 445-7203
  Regulatory   E911Ph2&TTY/TDD   Charles Spann   (903) 852-6798
  Product Deployment   CDMA NBSS SW   Mark Schwarzer   ESN 445-5851

October 10, 2001　　　　　　**TDMA TTY/TDD Regulatory FAQ/RFI**

Enclosed is information regarding Nortel Networks' plans to comply with the FCC's TTY requirements for TDMA service providers.

- What is the status of TTY/TDD network infrastructure software/hardware development and testing?

  Nortel response: Nortel Networks' TDMA TTY/TDD functionality is compliant to IS-823 (TTY/TDD Extension to TIA/EIA 136-410 Enhanced Full Rate Speech Codec) for the EFRC Codec. The development and product testing are complete and system verification is being performed. Nortel Networks has tested this feature with alpha/beta handsets from a few major vendors, which have all shown positive results. We anticipate receiving handsets containing commercial software from major vendors shortly and will conduct testing with those handsets.

  Nortel Networks plans to support new and evolved standards in next year's software releases. Operators will be able to deploy the Nortel Networks TTY solution i.e. MTX10, which is based on the current IS-823A standard, to meet the FCC deadline for implementation pending the availability of the stable commercial grade handsets from at least two vendors. At this point the TTY feature in MTX10 is being termed a "prep" feature due to the unavailability of commercial grade handsets.

- What is Nortel Network's TTY/TDD plans to test and confirm solution performance including additional tests referenced in Sections 20-23 of the FCC 4th Rule and Order 12-14-2000?

  Nortel response: Regarding Section 20-23, Turbocode and HiSpeed is each a proprietary feature of TTY device vendors Ultratec and Ameriphone, respectively. If TDMA standards are enhanced to support these devices, Nortel will support this in a future release. Standards are designed to avoid supporting proprietary methods, and Nortel Networks is not aware of any effort to standardize these proprietary features.

- What are the hardware baseline and software baseline to support TDMA TTY/TDD functionality?

  Nortel response:

Regulatory solution required	TDMA HW/SW baseline
TTY/TDD	EDSPM SW for the ICP; MTX10 SW for the DMS-MTX TTY capable handsets (3rd party)

- What software baseline must the MTX be running in order to upgrade to MTX10?

  Nortel response: The MTX is required to be running MTX09 in order to upgrade to MTX10. Nortel Networks has always maintained an allowance for CSP or Communication Services Platform "jumps" from MTX release to MTX release. The MTX has received significant changes due to moving to a multi-processing architecture thus the CSP layer has evolved to CSP14. It is because of this very different CSP14 layer of the MTX10 release that an MTX cannot upgrade safely from MTX08 directly to MTX10.

- What is the Network infrastructure software/hardware planned general availability dates that support the deployment of this regulatory feature?

  Nortel response: In order to comply with the FCC's December 31, 2001 requirement for TTY/TDD, Nortel Networks commits to delivering the enabling software as follows:

Nortel Networks Proprietary and Confidential

Software load	TDMA SW general availability
MTX09	Today
MTX10 TDMA	November 30, 2001*

* Nortel Networks is reviewing the possibility of MTX10 software becoming generally available to all our customers on November 9, 2001.

- For TTY/TDD what are the plans to work with any wireless carrier to perform end-to-end customer tests, and when will this occur?

  Nortel response: The verification process for MTX10 with the customer began in August 2001. Nortel has recommended that the operator engage their chosen TDMA TTY handset vendor during the verification process or VO process to participate in interoperability testing with the Nortel Networks solution. Nortel Networks recognizes that to date few if any handset vendors have published GA dates for TYY mobile handsets. To Nortel Networks knowledge, as of October 10, 2001 TTY capable handsets and compatible TYY/TTD devices have not been acquired by any of our service provider VO partners. Despite this fact, Nortel Networks' will not delay, but improve the delivery forecast of this software load for three weeks earlier than the planned November 30, 2001 GA date. This decision not to delay, but accelerate is driven by the importance of the TTY feature, and the positive results of the TTY/TTD internal testing. This early availability of the solutions will allow a greater number of our customers to become verification partners.
  Nortel Networks' forecast for this specific feature's full verification is planned to occur with our existing lead or verification partners in the November time frame.
  Operators are encouraged to request their handset vendors to test their commercial-grade TDMA TTY capable handsets in Nortel's Wireless Interoperability Lab.
  All verification activities are dependent upon the availability of commercial-grade TDMA TTY/TTD handsets.

- What are Nortel Network's plans to test their own or other vendor handsets with your switch solution?

  Nortel response: Nortel Networks provides only infrastructure for wireless networks. Nortel Networks does not provide mobile handsets. Even though the infrastructure software is scheduled in advance of the Dec 31, 2001 FCC requirement, commercial handset general availability dates have not been scheduled by handset vendors. Nortel Networks recommends that the operator engage its handset vendor(s) in order to respond to the FCC regarding handset availability.

  Operators are encouraged to request their handset vendors to test their commercial grade TDMA TTY capable handsets in Nortel's Wireless Interoperability Lab.

  Please contact Gerry Chaparro for scheduling TTY testing in the Nortel Networks Wireless Interoperability Lab, where testing is based on current published standards (Phone: 972-684-4622; Fax: 972-684-3881; mailto:chaparro@nortelnetworks.com)

- **Contacts:**

  Product Marketing MTX10 SW   Kurt Raaflaub   ESN 445-2971
  Product Management   TDMA TTY/TDD   Syed Zaidi   ESN 444-0403
  Regulatory   E911Ph2&TTY/TDD Charles Spann   (903) 852-6798
  Product Deployment   TDMA MTX SW   Shawn Moffat   ESN 444-4293

Nortel Networks Solution Status- Oct. 10th, 2001:

Nortel Networks will deliver TTY functionality in two phases. The first phase will deliver a transcoder solution for the BSCe3 since this solution was approved first by the standardization bodies. The second phase will deliver a transcoder solution with circuit pooling (the recent Change Request) for the BSCe3 and BSC2G.

Phase I Status:

This phase I will support TTY in all the codecs at the BSCe3/TCUe3. Circuit pooling is not supported.

Hardware Requirement: BSC e3/TCUe3

Software Requirement: BSS V13.2 or greater. NSS 13.0

Development Status: Completed September 2001

Test Status: Internal Testing with handsets and TTY devices began September 2001. One problem has been found that appears to be associated with TTY device non-compliance to TCB121. First customer test is planned to start in November 2001.

Concerns:

1. TTY handsets and devices used in internal testing are not in final form. Manufactures have identified changes they will make during or after Nortel's testing. So we don't know the impact of the changes to the TTY functionality solution stability or interoperability with these handsets/devices.

2. We are concerned that there may be problems with other TTY handsets/devices that we have not tested.

Phase II Status:

The software changes required to support Circuit Pooling would be available for field test by beginning of the second quarter 2002. This solution will be implemented on BSCe3 and BSC2G and a patch to NSS 13.

Hardware Requirement: Either BSCe3/ TCUe3 or BSC/TCU2G

Software Requirement: A patch is needed to BSS V13.2, and a patch is also needed to NSS13

Concerns:

1. The introduction of the circuit pooling solution at such a late point in the design development, combined with the emphasis on a solution delivery in 2001, is resulting in a multiple test effort to support a two-phase solution delivery.

2. The circuit pooling solution has been undergoing design changes, which is evident by the recent bit location change from Bit 5 to 6 and bit length change. Any additional changes will add further delays to the availability of the circuit pooling solution.

Pine Belt Cellular, Inc.
3984 County Road 32
P. O. Box 279
Arlington, Alabama 36722

TTY Report – October 11, 2001

Pine Belt Cellular, Inc. is completely reliant upon its vendors to implement the TTY solutions in its handsets and network. Pine Belt does not have the ability to independently verify the release dates of the solutions that will be provided by the vendors.

1.) Network infrastructure software development:
Lucent Technologies, our switch and infrastructure manufacturer is aware of the TTY requirements. Our understanding is that Lucent is currently working on software solutions at this time. Pine Belt is dependent upon Lucent providing these solutions.

2) Handset development and testing plans:
Pine Belt Cellular uses handsets made by a number of manufacturers. The manufacturers most predominantly used by Pine Belt are Motorola, Nokia, and Kyocera. Pine Belt will stay abreast of the developments by these manufacturers so when TTY solutions are made available, we will be able to provide these units to our customers as soon as possible.

3) Beta testing and lab testing:
Pine Belt Cellular will begin testing TTY compatible equipment as soon as both our handset and infrastructure manufacturers provide solutions to us.

4) Release and general availability to carriers of network infrastructure software
Pine Belt Cellular is awaiting updated reports of software availability from switching and infrastructure vendors.

5) Availability to carriers of full acceptance test units:
Pine Belt Cellular is awaiting software and hardware availability from switching, infrastructure, and handset vendors.

6) Efforts toward achieving digital wireless solution compatibility with enhanced TTY devices:
Pine Belt Cellular remains dependent upon the availability of vendor provided solutions to meet the FCC's tentatively mandated timeline (12-31-01) to provide E911 TTY access to our networks.

7) Carrier coordination of testing with PSAP:
This testing target date is dependent upon solutions provided by network infrastructure vendors and handset vendors.

8) Carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests:

    Testing will begin immediately upon receipt of software and hardware. Pine Belt Cellular is dependent upon network infrastructure vendor solutions.

9) Retail availability of necessary consumer equipment:

    Pine Belt Cellular is dependent upon the availability of handsets from vendors. No firm commitment has been received at this time from handset vendors.

10) Geographic scope of network infrastructure deployment:

    Pine Belt Cellular service area: Alabama RSA3B2 & BTA415

SpectraCom, Inc. d.b.a PYXIS Communications
TTY Report
Monday, October 08, 2001

PYXIS Communications uses CDMA technology to provide digital wireless service in all of our markets. PYXIS Communications is completely reliant upon its vendors to implement the TTY solution in its handsets and network.

Infrastructure Vendor Status
Nortel is PYXIS' infrastructure provider. We did not receive an updated response from Nortel in time to make this filing. Their response from our previous filling in April and July 2001 was as follows:

> **Nortel Network Solution Set**
> The Nortel Network software solution is in release MTX-10, scheduled for general availability week 44, 2001.
>
> **Development and Testing**
> Lab testing has not identified problems – in house testing has been done with one handset. Lack of availability of CDMA test handsets prevented testing of a wider range of subscriber apparatus.
>
> **Product Time Line**
> MTX-10, scheduled for general availability week 44, 2001, supporting code for the IS-127-2 & IS-733-1 standards, and at least one function of the code relating to the future IS-127-3 & IS-733-2 standards.
>
> **Issues and Concerns**
> - The changes to CDMA TTY/911 code, and the coming standard change has created much difficulty to design solutions to a "moving target".
> - The FCC's date for carriers to acquire TTY/911 equipment is December 31, 2001; a standard change is expected in April 2001. There is not sufficient time between April and December to fully evaluate all changes, and incorporate all proposed changes in software that customers will have in December
> - Some proposed changes are more important than others. Manufacturers can incorporate important changes without incorporating all.   It is not known how different equipment using different mixes of equipment will interoperate
> - <u>Nortel Networks believes standards must be "locked down" for equipment developers to design to a common target for initial equipment deployment.</u> Future changes in initial equipment standards should provide time developing a stable and fixed second round design target
> - Industry solutions only support Baudette 45.5 TTY transmissions, propriety TTY transmissions, and European Baudot 50 is not supported.

- Ericsson has filed a Report Number 47 with ATIS that identifies a test failure where the Voice Recognition function is incompatible with the existing TTY Detector. It is not clear if the recent Lucent code change will cure this problem, or if the problem applies to Nortel Network equipment and software.

Handset Vendor Status

KYOCERA Response:
According to engineering Kyocera has plans to implement TTY into our 2002 product road map.

Motorola response:
No update/response has been received from Motorola.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of:)
)
Revision of the Commission's Rules   )
To Ensure Compatibility with   )
Enhanced 911 Emergency Calling Systems   )   CC Docket 94-102
)
Third Reporting   )
)
To: The Commission   )

QWEST WIRELESS, LLC AND TW WIRELESS, LLC'S THIRD QUARTER 2001
REPORTING TO BE FILED THROUGH TTY FORUM

Pursuant to the Commission's Fourth Report and Order, dated December 14, 2000, in the CC Docket referred to above, Qwest Wireless, LLC and TW Wireless, LLC[5] (collectively, "Qwest") hereby submit their third report to the TTY Forum for compilation and timely filing with the Commission.

1.   Network Infrastructure Software Development

In its Lucent markets, Qwest continues to be on track for timely hardware and software installation before the end of the year. At the present time, Qwest is actively upgrading its PHV2 protocol handlers to PHV4 protocol handlers. The PHV4 will be TTY compatible through a software feature.

In its Ericsson/Nortel markets, also referred to as PCSAN markets, however, Qwest continues to face delay with respect to installation of the necessary software upgrade C-RAN 8.6. Ericsson notified Qwest that FOA release of C-RAN 8.6 is tentatively scheduled for January 15, 2002. Commercial release is scheduled for February 15, 2002. Qwest will receive the upgrade at the commercial release date. Qwest will be able to begin testing in those markets by April 2002. Qwest still expects to meet the final deadline for complete TTY 911 compatibility in all of its markets by June 30, 2002.

2.   Handset Development and Testing Plans
No updates from last reporting.

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[5] Qwest Wireless, LLC, together with TW Wireless, LLC, a joint venture in which Qwest Wireless, LLC holds a majority equity and sole controlling ownership interest, provide broadband PCS services in a number of markets, This filing is submitted on behalf of both Qwest Wireless, LLC and TW Wireless, LLC.

3.   Beta Testing and Lab Testing
No updates since last report.

4.   Release and General Availability to Carriers of Network Infrastructure Software.
See answer to question 1.

5.   Availability to Carriers of Full Acceptance Test Units
No updates since last report.

6.   Efforts Towards Achieving Digital Wireless Solution Compatibility With Enhanced TTY
        Devises
No updates since last report.

7.   Carrier Coordination of Testing with PSAPS.
No updates since last report.

8.   Carrier Testing Activities
No updates since last report.

9.   Retail Availability of Necessary Consumer Equipment
No updates since last report.

10.   Geographic Scope of Network Infrastructure Deployment.
No updates since last report. *See also* answer to question 10.

Respectfully Submitted:

/S/   Floy H. Jeffares
_____

Floy H. Jeffares, Manager, Policy and Law

TTY Forum #19 Carrier Status Report
October 10, 2001
Rural Cellular Corporation for itself and its affiliates (collectively "RCC")

1. Network Infrastructure Software Development

    TDMA Networks: RCC utilizes TDMA infrastructure from Lucent, Ericsson and
    Nortel.   RCC is relying on these three infrastructure vendors to complete software
    development.

    GSM Network: RCC is currently evaluating options for TTY support over GSM.

2. Handset Development and Testing Plans

    RCC is relying on its handset vendors for the development and testing of TTY
    capable handsets. Once handsets are available for testing, RCC will perform field
    tests in accordance with the Loeber and Walsh test plan submitted to the TTY Forum.

3. Beta Testing and Lab Testing

    Once TTY capable software is in place and handsets are available, RCC will begin
    field tests.

4. Release and General Availability to Carriers of Network Software

    RCC's infrastructure vendors have stated that the software releases to support TTY
    capability should be available by December 2001.

5. Availability to Carriers of Full Acceptance Test Units

    RCC is waiting for commitments from its handset vendors for the date that they will
    have full acceptance test units available.

6. Efforts Towards Achieving Digital Wireless Solution Compatibility with Enhanced
    TTY Devices

    RCC is working with its vendors and now with the TTY Forum to achieve a standard
    to support enhanced TTY devices.

7. Carrier Coordination of Testing with PSAP

    RCC will conduct TTY testing with any PSAP that requests testing.

8. Carrier Testing Activities, Including Field Testing and Consumer End-To-End Testing

RCC will conduct consumer end-to-end testing after acceptable handsets and infrastructure software upgrades are in place and tested.

9. Retail Availability of Necessary Consumer Equipment

Retail availability is uncertain at this time.

10. Geographic Scope of Network Deployment

RCC is proceeding on a path that assumes it will be able to meet a June 30, 2002 deployment deadline.

Siemens
TTY Report
October 15th, 2001

Siemens is investing a significant amount of effort in order to comply with the FCC requirement to support E911 calls made from TTY devices on wireless digital networks. The status provided below is based on the currently available TTY/CTM standards and assumes no changes to these standards.

Network Implementation

Siemens is currently developing a BSS based TTY solution. This is a "Transcoder Pooling" solution now referred to as "CTM circuit pooling solution". This solution may be implemented as an external network element on the A- interface or integrated within the TRAU. The Siemens solution will not impact the existing vocoders already deployed and supported by Siemens.

Siemens expects the first prototype units (including the necessary hardware and software) to be available for internal testing in December 2001. Following these tests the Siemens prototype solution will be made available to the wireless operators for network and interoperability testing. This will allow sufficient time for the network integration testing required to meet the in service date of June 2002.

Handsets Implementation

Siemens Handset group will support TTY in 2002. Siemens will support TTY/CTM via an accessory cable and the handset will support the GSM bearer bit capability for signaling from the handset to the network.

Respectfully submitted,
Ilan Vardi
Siemens

Southern LINC®

SOUTHERN COMPANY

Energy to Serve Your World℠

Southern LINC® TTY Status Report
3rd Quarter 2001

Southern LINC hereby submits its status report for 3rd Quarter 2001 in accordance with the reporting requirement contained in the Federal Communications Commission's Fourth Report and Order in CC Docket No. 94-102. Southern LINC continues diligently to pursue compliance with the FCC's TTY requirements. It regularly reviews the status and availability of an iDEN TTY solution with its sole vendor, Motorola, to ensure its ability to meet the FCC's deadline of June 30, 2002. Based upon the information it has received from Motorola, Southern LINC is currently of the belief that it will be able to deploy TTY capability to its customers by June 30, 2002.

Development Activities: Southern LINC continues to communicate with Motorola regarding the development status of TTY capability for iDEN networks.

Testing and Deployment Activities: Motorola has completed the development and integration work required for iDEN handsets, and Southern LINC has begun selling TTY-capable handsets to its customers. Even though the handsets are now TTY-capable, work continues on the network infrastructure changes (namely software upgrades) needed in order to provide TTY calling capability on an iDEN system. It is Southern's understanding that these changes are in the testing stage. Once the software is ready for general release, and Southern has installed it, Southern LINC will test the iDEN TTY solution. Its plans for testing will incorporate the public safety community to ensure compliance for 911 calling purposes.

Geographic Scope of Network Infrastructure Deployment: Southern LINC is a regional carrier providing service in Georgia and Alabama and portions of Florida and Mississippi. Its deployment of an iDEN TTY solution will encompass its entire network.

As its plans for testing and deployment become more concrete, Southern LINC will be pleased to share that information with the Commission in a future report.

For questions regarding this report, please contact:

Holly Henderson
Regulatory Affairs Manager
Southern LINC®
5555 Glenridge Connector, Suite 500
Atlanta, GA 30342
678.443.1670

Sprint PCS Report to the FCC
Prepared: 10/10/01

1. *Network Infrastructure Software Development*
   - Sprint PCS has now received software from all but two of its four network vendors. While testing has now begun, the delay in delivery of software (originally expected in first or second quarter of 2001) has reduced the amount of time Sprint PCS normally has to test and implement a new technology of this scope.
   - Sprint PCS continues to encounter difficulties when testing the software in our labs, thus inhibiting our ability to begin field testing in the planned time frames. We continue to be concerned with the time it may take for network vendors to add the bug fixes.
   - We are looking to the FCC to hold infrastructure software manufacturers accountable if Sprint PCS is unable to meet the 6/30/02 deadline due to network infrastructure problems.

2. *Handset development and testing plans*
   - TTY compatibility is dependent on Qualcomm's DMSS software (reference software integrated into their handset) distributed to licensees in April and May of 2001. Following this release, handset manufacturers need to build a user interface (software).
   - Sprint PCS has received handsets from four vendors and expects our remaining vendors to deliver handsets in the first part of 2002.
   - Interoperability testing w/ infrastructure has begun, but has been limited to a laboratory setting.
   - We have encountered difficulties with our interoperability tests but have not isolated the problems to the handsets. Should the difficulties be isolated to the handset, Sprint PCS will need the cooperation of handset vendors to fix the bugs quickly.
   - We are looking to the FCC to hold handset manufacturers accountable if Sprint PCS is unable to meet the 6/30/02 deadline due to handset problems.

3. *Beta testing and lab testing*
   - SPCS requires lab, field testing, and beta testing (in that order) prior to implementation. Our internal lab testing and field testing are extremely intensive and require approximately two to three months each.
   - Lab testing is under way with field tests expected to begin within the next two months.

4. *Release and general availability to carriers of network software*
   - Two of our four network infrastructure vendors have provided software that supports TTY. We have requested software supporting TTY from the remaining infrastructure vendors as soon as it becomes available.
   - No network software has been released from Sprint PCS' lab

5. *Availability to carriers of full acceptance test units*
   - See # 2

6. *Efforts toward Achieving digital wireless solution compatibility with enhanced TTY devices.*
   - Sprint PCS is not pursuing a resolution of proprietary enhanced protocols as the FCC has temporarily relieved carriers of this responsibility. Sprint PCS will reevaluate enhanced protocols when industry standards supporting these protocols are in place.

7. *Carrier Coordination of testing with PSAP*
   - PSAP testing will be conducted at the time of field tests and beta trials.

8. *Carrier testing activities, including field testing, consumer end-to-end testing*
   - Sprint PCS is planning to test with consumers (including Gallaudet University) in various markets prior to nation-wide deployment.
   - In addition, Sprint PCS has become involved with the ATIS TTY Technical Standards Incubator (TTSI) program and hopes to participate in an "incubator" field test in which carriers and vendors gather to perform a field test.

9. *Retail availability of necessary consumer equipment*
   - TTY capable handset sales are projected for first quarter 2002.

10. *Geographic scope of network deployment*
    - SPCS plans to launch in specific markets in 2002, with nation-wide launch completed by June 30, 2002.

TeleCorp PCS
1010 North Glebe Road
Arlington, VA 22201

Contact:
John Garner
Director, Regulatory Compliance
601-209-8201

Date: October 10, 2001

Purpose: TeleCorp PCS, Quarterly TTY/TDD Report for all Lucent MSC
served markets

TeleCorp PCS is fully compliant with all TTY requirements in all Lucent MSC
served markets.

Date: October 10, 2001

Purpose: TeleCorp PCS, Quarterly TTY/TDD Report for all Ericsson Markets

Development Activities

1. network infrastructure software development;
   See Attachment 1: Ericsson document: "Carrier Verbal Report Forum 19 092501e"
2. handset development and testing plans;
   See Attachment 1: Ericsson document: "Carrier Verbal Report Forum 19 092501e"
3. beta testing and lab testing;
   See Attachment 1: Ericsson document: "Carrier Verbal Report Forum 19 092501e"
4. release and general availability to carriers of network infrastructure software;
   no formal commitment to availability has been received from Ericsson as of this date.
5. availability to carriers of full acceptance test units;
   See Attachment 1: Ericsson document: "Carrier Verbal Report Forum 19 092501e"
6. efforts toward achieving digital wireless solution compatibility with enhanced TTY devices;
   See Attachment 1: Ericsson document: "Carrier Verbal Report Forum 19 092501e".

Testing and Deployment Activities

7. carrier coordination of testing with PSAP;
   Tritel will utilize relationships developed during Phase I E911 implementation to arrange end to end testing.
8. carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests;
   See Attachment 1: Ericsson document: "Carrier Verbal Report Forum 19 092501e"
9. retail availability of necessary consumer equipment;
   See Attachment 1: Ericsson document: "Carrier Verbal Report Forum 19 092501e"
10. geographic scope of network infrastructure deployment;
    Tritel has made no deployments as of this date.

Attachment 1
Ericsson Document: "Carrier Verbal Report Forum 19 092501e"

Matt Kaltenbach Ericsson, September 25th, 2001

Ericsson is submitting the following extracted information to Carriers and the KAM representatives regarding the current TTY status. This information is to be presented at the TTY Forum #19 in a verbal presentation during the September 26, 2001 meeting. Ericsson will *italicize* the verbal information.

History
At the TTY Forum 18 several manufacturers pointed out risks and concerns with respect to meeting the compliance requirements defined by the FCC.

- *The need for a Switch to turn on and off TTY in the mobile was requested.*
- *The need to freeze the TTY SW code standards was requested and discussed.*
- *Manufacturers reported various audio quality issues when TTY was turned on within the network and mobile*
- *Various manufacturers discussed testing plans, and action items that required additional testing and reporting.*
- *Digital Wireless Solution Compatibility with Enhanced TTY Devices;*
    - *Limited to successful transmission of Baudot tones for E911 applications using TIA/EIA IS-823 and IS-840 standards.*
    - *Turbo mode incompatibility with digital cellular systems (Cingular work item)*
    - *Recent standards adoptions planned for CTM (GSM systems).*

Subsequent to the last meeting problems and resolutions with network and terminal products have been accomplished in the areas of self echo, IS-823 bit exact code performance, CTM Detector bit length, and movement of the CTM bearer bit from Octet 3a bit 5 to Octet 3a bit 6.

Additional technical issues remaining include echo suppressor testing, IS-641 filter influence on TTY, vendor interoperability testing, full industry testing, Voice Carry Over (VCO) voice quality, Hearing Carry Over (HCO) voice quality, and usability testing with Gallaudet.

Executive Summary:

For all the technologies, in general, technical feasibility to transport TTY across digital cellular systems has been proven in the labs and early test events. Technical issues and system integration issues flaws have been identified, and the majority of those flaws have been solved and tested. A few low risk technical issues have been discovered recently, late in the schedule. Several remaining system integration issues require resolution and vigilance to resolve on the remaining schedule. The remaining issues have a low technical risk. System build code, release configuration, and diagnostic tests and release process are under way for final release, when the appropriate approval schedule gate is achieved.

Detailed Development Activity Status

(1) Network Infrastructure Software Development;

TDMA Network

- TDMA functional test complete. TDMA initial development test complete. IS-823 standard changes incorporated, and regression testing underway.

- The TDMA final Development release is expected October 31, 2001.

- FOA testing is currently scheduled for November 01- 12

> *The Development of Code for the TDMA Network Infrastructures was completed on July 31, 2001. Changes in IS-823 standards and problems with self-echo within the network for TTY signals were addressed in a patch to TRAB 2 products on August 12, 2001. This fix was tested and continued to exhibit problems with certain Mobile and TTY terminal product combinations. Resolution of the IS-641 filter problem has since solved this problem. Final regression tests and delivery of Ballot changes from September to repair the 50-baud problem are to be released for test on October 01,2001. Final regression TRAB 3 software release was on September 17th, 2001. Early results of the TRAB 3 test cases are encouraging for the recent ballot fixes. The vast majority of development test cases are complete for TDMA, and "Final Development Release" is expected shortly.*

GSM Network

- The GSM initial development products have been constructed and released to the Richardson location test facility.
- Development functional testing complete, and release to development verification testing occurred on September 24th, 2001.
- The development code release to Carriers is available November 15th, 2001.
  > *The initial code and products to deliver the circuit pooling node for the GSM Network Infrastructure was made on September 24th, 2001 to Richardson Texas. The product includes both hardware and software components, that when combined provide the CTM function for TTY. The initial functional testing occurred during August, and performed satisfactorily. The Richardson test facility will be starting Development testing*

immediately. The CTM code has been pre-tested and completed cursory development tests. The CTM performance was within the 1-% error rate limits. There have been changes to the Technical standards for TTY detection, which have required the number of TTY bits in the Detector to be reduced from 5 bits to 4 bits. These changes have been incorporated in the initial development release of the code. The current implementation implements the ballot-accepted versions of the 3GPP standards in all other respects. The Development of Code for GSM is scheduled to be completed by October 31, 2001. The system verification testing release is expected to be released on November 14th 2001. The release to carrier infrastructure for testing of development code will be November 01, 2001.   s are continuing to develop the provided SW code as defined for the respective technology.

CDMA Network

The CDMA network code is currently under development. No preliminary development test results are available.

(2) Handset Development and Testing Plans;

Handset Development Status

TDMA

- TDMA Handsets are slightly behind schedule but have encountered significant problems in the development integration process with system elements.
- A release development build occurred on September 25th, 2001 for carrier development product testing.
- Carrier development test units are expected to be available on October 31, 2001
- Carrier test units to customer level are expected to be available on December 03, 2001.
- Volume availability is expected March 31, 2001.

  - *Software development complete*
  - *Final handset products are in development test*
  - *Prototype testing revealed problems with the standard, and with TTY devices. Fixes for Self-Echo, volume level, IS-641 filtering problem, and 50-baud errors. Development code release September 21, 2001. Carrier Test units availability release September 27th, 2001.*
  - *TDMA development testing provided a 0.6-% maximum (0.25% average) error rate when tested for various TTY devices, and configurations, in a static configuration. Error rates of less than 0.5-% were measured with a –95 dBm RSSI level*

- *Final User interface for Carrier testing to be incorporated in design by December 03, 2001.*

GSM

- GSM handsets are slightly behind schedule, and were delayed due to standards activities not completing until July 21, 2001. Minor changes to standards have had minimal impact to the GSM development schedule.
- Carrier test units to Development level are expected October 12th, 2001
- Carrier test units to customer level are expected to be available on December 31, 2001.
- Volume availability is expected on February 20, 2001.

- *Software development is complete for terminal and CTM box.*
- *Final handset products are in development test*
- *Prototype testing revealed problems with the standard, and with TTY devices. Fixes for TTY detector bit length was implemented. TSB 121 level interface testing also required fixes to the TTY product. Development code released September 09, 2001. Carrier Test units availability release September 12th, 2001.*
- *Preliminary testing on Nortel Infrastructure was good. Bearer bit changes from July 18th 2001 change requires software change (complete September 25th, 2001.*
- *Products for testing on Lucent Infrastructure released September 21, 2001.*
- *GSM development testing provided a 0.5-% maximum (0.18% average) error rate when tested for various TTY devices, and configurations, in a static configuration. Error rates of less than 1-% were measured with a –105 dBm RSSI level*
- *Final User interface for Carrier testing to be incorporated in design by December 31, 2001.*

CDMA

- CDMA Handsets are slightly behind schedule but have encountered problems in the development integration process with TTY devices..
- A release development build occurred on September 12th, 2001 for testing on Lucent Infrastructure. The test was delayed due to the events in September.
- Carrier development test units are available.
- Carrier test units to customer level are expected to be available on October 31, 2001.
- Volume availability is expected by December 03, 2001.

- *Software development complete March 31, 2001.*
- *Final handset products are in development test*
- *Prototype testing revealed problems with the standard, and with TTY devices. Fixes for Self-Echo have been implemented.*
- *CDMA development testing provided a 0.18-% maximum error rate when tested for various TTY devices, and configurations, in a static configuration.*
- *Final handset user interface for Carrier testing is currently being finalized.*

(3) Beta Testing and Lab Testing;

TDMA Infrastructure Beta Testing and Lab Testing

Standards Level for Transcoder solution
- *TIA/EIA PN3-4614-RVX (IS-823B), 2001-09-09 (with ballot changes accepted September 09, 2001, Lucent ballot attachment for 50 baud fix, and fixes to IS-641),*
- *TIA/EIA PN3-4721-RV1 (IS-840), 2001-03-19.*

- Beta Testing of TDMA software was completed on Revision 24 of Trab 2 software.
- Beta Testing of TDMA software for Trab 3 is under way and scheduled to complete by October 17th.
- TDMA Network Infrastructure was tested at the ATIS Incubator Test even September 10 – 14th in Lisle IL. The test for Trab 2 software produced very favorable test results. While not all tests were completed, those that were demonstrated a fully functional technology, with a usable error rate.

GSM Infrastructure Beta Testing and Lab Testing

Standards level for Network Infrastructure

- *3GPP Standards Level June 21, 2001.*
- *Incorporates TR32.231 Bit Exact Changes Dated September 03, 2001 (changes TTY detector from 5 bit to 4 bit length.*
- *Incorporates July 21 changes to July 06 draft documents (bearer bit from octet 3a bit 5 to bit 6)*

- Development functional testing complete September 24th, 2001.
- Development testing scheduled for completion November 15th 2001.
- CTM Circuit Pool Solution FOA planned for November 2001

- Network software and hardware can be ordered now (14 week lead time)
- Volume deliveries can start in December 01

CDMA Infrastructure Beta Testing and Lab Testing

- CDMA testing is currently being gated by the release of development code.
- CDMA test planning and test case generation are in process.

(4) Release and General Availability to Carriers of Network Infrastructure Software;

TDMA Infrastructure GA December 05, 2001

GSM System generally available (GA) with GSM R9.0 (Starting Rollout January 15 2002)

CDMA Generally Available with system Release 8.6 (Starting Rollout February 28, 2002)

(5) Availability to carriers of full acceptance test units;

- *TDMA Handsets December 03, 2001*
- *GSM Handsets and CTM box December 31, 2001*
- *CDMA Handsets October 31, 2001.*
- *TDMA Network Infrastructure October 22, 2001*
- *GSM Network Infrastructure November 15, 2001*
- *CDMA Network Infrastructure date TBD.*
-

(6) Efforts Toward Achieving Digital Wireless Solution Compatibility with Enhanced TTY devices.;[6]

Ericsson continues to work very closely with all manufacturers and carriers on the TTY compatibility mandate. Ericsson continues to work closely with the ATIS incubator, and the TTY forum. Ericsson has taken a leadership position in the debug, test, and isolation of potential customer and user anomalies that have resulted in changes to the product standards or in implementation techniques. Ericsson is currently developing tests in VCO, HCO, and with V.18 technologies that are in a leadership position in the industry. Ericsson has authored and pioneered work in system integration issues including echo suppressors, network echo, leaky voice bits, IS-641 filter compatibility, User interface implementation, Turbo code compatibility issues, and others. Ericsson will continue to work

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[6] *See* discussion of enhanced protocols, paragraphs **Error! Reference source not found.**-**Error! Reference source not found.**, *infra*.

towards the trouble free first pass implementation of TTY technology for all the Digital wireless solution systems.

(7) Testing and Deployment Activities

(7) Ericsson helped create the ATIS Incubator which is taking a leadership position in testing and coordinating carrier development tests of TTY technology. The first industry test event tested TDMA Infrastructure for Lucent, and Ericsson, and handset products from Motorola, Ericsson, and Panasonic. The tests demonstrated operation, static operation, operation with various TTY devices, Calling configurations of mobile to mobile, mobile to landline, mobile to PSAP, and others. Driving and AMPS tests were also conducted. While cut short, the tests clearly went along way to validate the technology in an actual operational setting.

- *Additional test events, and test scenarios are planned with future improvements for 711 relay, 911 PSAP testing, usability, and TTY device testing.*

- *Ericsson has developed lists of tests to support the required testing within the PSAP operators. Although this list is not intended to be a complete list, we have communicated it to various PSAP'S and initiated efforts to include these tests within the ATIS Incubator Tests.*

- *We have assumed the total list will need to be performed between all the E-911 participants, the users, the manufacturers, the carriers, and the Call centers, although only some tests may be conducted by each party.*

- *Manufacturers will validate self-operation and compliance under the FCC mandate. The attached list with PSTN to cell, and cell to cell, compliance to specification, operation with multiple types of TTY devices, assure User Interface (UI), and validate FCC mandated operation requirements.*

Carriers should be able to solely focus on interoperability and system compatibility test cases, since ATIS and manufacturers are covering Technology, system integration, compatibility, and operational testing.

911 call centers may have to validate call setup, conformance to system architecture, and exception cases, and all known previous failure scenarios, to validate fixes to standards.

1. *Call setup compatible with E-911*
2. *Test: Automatic call routing*
3. *Conforms to and capable of: 96-198 p35-43 limited by 98-181 IVR, voicemail, OVR, requirements*
4. *Compatible with: SPC service creation, call waiting, call forwarding, 3 way (party) calling from PSAP center, 3 Way calling for SIM-less GSM phones,*

CCS operability, IN architecture test, CLASS 800 Services , Alternate Billing Services (ABS), ABS Area Number Calling

5. Test: Time to complete call
6. Test: Time to determine position
7. Test: call back capability
8. Test: Caller ID
9. Portable number
10. 17 second rule
11. EOTD accuracy test
12. TTY capability with 45 Baudot
13. TTY capability with 50 Baudot
14. TTY capability with V.18 Device
15. Test: TTY error rate for AMPS, CDMA, TDMA, GSM (45 Baudot)
16. Test: TTY (minimum performance specification in standard) MPS for each cellular technology
17. 3 Way call between any technology
18. 3 Way call between any carrier
19. Emergency signaling tones interference and false TTY test
20. International signaling tones interference and false TTY test (In V.18)
21. TTY mode on/off during call with E-911
22. GSM Bearer Bit on, with not CTM on the call, for each carrier and method.
23. Voice Quality, score, volume level, automatic switching between TTY to TTY, VCO to TTY, and TTY to HCO, drive PER should be less than 1% (Drive level, RF path loss, fading), error rate of any symbol should be less than 1%,
24. TTY error rate for one character at a time, and long pause first character error rate, switching between text and speech within 1 second, typing speed of 7 characters per second, PER Average less than 1%.
25. Validation that noise in either path does not cause double talk cancellation in echo suppressors.
26. TTY operation error rate should be tested for each type of carrier trunking (PCM, ADPCM) to validate that system error rate is < 1%.
27. Test TTY Cell hand off error rate, and resynchronization of each cellular technology
28. Test TTY data in presence of noisy channel (microphone on) to validate communication possible.
29. Test Operation with one, one and a half, and two stop bit TTY devices.
30. TTY mode control tested, carrier test mode designed to failsafe
31. Dwell test of repeated TTY calls to validate all calls connect repeatedly (Baseline)

(8) Carrier Testing Activities, Including Field Testing, Consumer end-to-end testing, and other necessary tests;[7]

- See number 7 above.

(9) Retail Availability of Necessary consumer equipment; and

- N/A

(10)   Geographic scope of network infrastructure deployment.[8]

- N/A

(11)   Identify all technical issues currently being addressed.

- *Existing Issues That are Open:*
  - *Diagnostic tests and completion of all network test cases.*
  - *System Software Default configuration*
  - *IS-641 filter changes validated in all products*
  - *Interoperability with other manufacturers*
  - *Completion of ATIS Incubator Testing Procedures for all ATIS Test Events*
  - *Completion of HCO/VCO testing*
  - *Completion of Echo Suppressor testing*

Please feel free to contact either Matt Kaltenbach or Steve Coston if you have any questions regarding the supplied information.

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[7] SBC and the TTY Forum suggested certain of these criteria for the reports. *See* SBC Reply Comments at 4; Minutes of TTY Forum Meeting 16 (Nov. 9, 2000).

[8] Each quarterly report may not necessarily cover each of the listed milestones, as certain milestones may not yet have been reached as of the due date of a particular quarterly report.

TMP CORPORATION
TTY REPORT
October 2, 2001

The following information is based on representations made to TMP Corporation by its vendors. TMP Corporation does not have the ability to independently verify these release dates. TMP Corporation is completely reliant upon its vendors to implement the TTY solution in its handsets and network. At the present time TMP does not have an operational system; however expects to be on line by late fall of 2001.

1. **Network infrastructure software development**
   Tecore, our switch manufacturer and AirNet our infrastructure manufacturer are aware of TTY requirements. Software compliance is under evaluation at this time.

   TMP Corporation is dependent upon a solution being made available by the infrastructure vendors.

2. **Handset development and testing plans**
   At this point we are working with handset manufacturers to validate a solution for deployment in our network by the date tentatively set by the FCC.

   The absence of a firm commitment by manufacturers of TTY compatibility for PCS handsets remains a major concern for TMP Corporation to provide appropriate handsets and support the 12-31-01 FCC mandated deadline.

   We have and will continue to work with our handset vendors to ensure TTY access to E911 for our consumers.

3. **Beta testing and lab testing**
   TMP will begin testing TTY compatible equipment dependent upon solutions provided by network infrastructure and handset vendors.

4. **Release and general availability to carriers of network infrastructure software**
   TMP Corporation is awaiting updated reports of software availability from switching and infrastructure vendors.

5. **Availability to carriers of full acceptance test units**
   TMP Corporation is awaiting software and hardware availability from switching, infrastructure, and handset vendors.

6. **Efforts toward achieving digital wireless solution compatibility with enhanced TTY devices**

   TMP Corporation remains dependent upon the availability of vendor provided solutions to meet the FCC's tentative mandated timeline (12-31-01) to provide E911 TTY access to our networks.

   We expect the GSM functional performance to be similar to the other technologies and meet or exceed all of the TTY Forum's Consumer Group requirements.

   Much work will need to be done to implement the GSM solution in our networks over the next year.

7. **Carrier coordination of testing with PSAP**

   PSAP Testing Target Date: 9-1-01. This testing target date is dependent upon solutions provided by network infrastructure vendors and handset vendors.

8. **Carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests**

   Testing will begin immediately upon receipt of software and hardware. TMP is dependent upon network infrastructure vendor solutions.

9. **Retail availability of necessary consumer equipments**

   TMP Corporation is dependent upon the availability of handsets from vendors. No firm commitment has been received at this time from handset vendors.

10. **Geographic scope of network infrastructure deployment**
    TMP service area – BTA 367

US Cellular TTY Forum 19 Quarterly Report

1. *Network infrastructure software development*
   US Cellular is relying on its infrastructure vendors to complete software development.
   US Cellular deploys CDMA using Nortel and Lucent platforms and deploys TDMA using the Nortel Platform.

TDMA

Nortel development and product testing conforms to TIA/EIA 136-410 (EFRC Codec)

CDMA

Nortel development and product testing conforms to IS-127-2 (EVRC) and IS-733-1 (13K vocoder)
Nortel plans on supporting IS-127-3 and IS-733-2 at a later date. Initial implementation will be meeting IS-127-2 and IS-733-1.

Lucent release 17 will support the latest standards.

2. *Handset and development and testing plans*
   US Cellular is relying on the handset vendors for the development of any product. When terminal units are available, US Cellular will perform field-testing in accordance with the Loeber and Walsh test plan, previously submitted in the TTY Forum.

3. *Beta testing and lab testing*
   US Cellular is only able to field-test beta units. Testing of beta units will only take place after the final release of the infrastructure is in place. Presently, there are no beta units available.

4. *Release and general availability to carriers of network software*
   US Cellular has commitments from Lucent (CDMA) that release 17 will be available during November 2001.

   Nortel (CDMA) has forwarded the following to US Cellular

Software load	CDMA SW general availability
MTX09	Now available
NBSS10.1 with MTX09	October 12, 2001
MTX10	December 7, 2001

   Nortel (TDMA) has forwarded the following to US Cellular

Software load	TDMA SW general availability
MTX09	Today
MTX10 TDMA	November 30, 2001

5. *Availability to carriers of full acceptance test units*
   US Cellular is awaiting a firm commitment from its handset suppliers for the availability of full acceptance test units.

6. *Efforts towards achieving digital wireless solution compatibility with enhanced TTY devices.*
   US Cellular will work with the various manufacturers to achieve a standard to transport enhanced TTY devices (proprietary faster turbo codes). Our infrastructure vendors are not supporting enhanced protocols at this time.

7. *Carrier coordination of testing with PSAP*

US Cellular will conduct TTY testing with larger PSAPs in its coverage area and with any PSAP that requests testing. No requests have been received. Scheduling of these tests will commence after acceptable handsets and infrastructure equipment is in place.

8. *Carrier testing activities, including field testing, consumer end-to-end testing*

Scheduling of consumer end-to-end testing will commence after acceptable handsets and infrastructure equipment is in place.

9. *Retail availability of necessary consumer equipment*

There are no available TDMA and CDMA handsets available that will pass TTY Baudot tones. There are no firm schedules from our handset suppliers for the availability of production units. Retail availability is uncertain at this time.

10. *Geographic scope of network deployment*

US Cellular is planning on having the "Network" portion of the TTY solution installed in all our CDMA and TDMA markets throughout the country. Deployment will initially be deployed on a limited basis to insure that the network integrity is not compromised.

Rollout of a new software load is a lengthy process. Since software releases often change the billing format, upon initial release of the software, USCC must request sample billing data from Nortel and Lucent and validate that these changes have not diminished USCC's capacity to produce an accurate bill. Frequently, USCC must modify its internal billing software in order to accommodate changes made by Nortel and Lucent to the billing format in the new software load. This requires a minimum of ninety days. Only then can USCC begin upgrades to its switching network, beginning with one switch.

In full production, USCC can accommodate upgrades to two switches per week. Hardware upgrades are usually required with each software upgrade. Nortel requires a 28 day "soak" period from the time of hardware installation before the software upgrade can be run. In addition, CDMA systems are more complex given that software and hardware upgrades are required for two network elements, both the Mobile Switching Center (MSC) and the Base Station Controller (BSC).

By way of example, USCC anticipates completion of the MTX09 upgrade, which began in February, 2001, by the end of October, 2001. This upgrade was considered a "light load," as it did not require significant hardware upgrades. USCC has 50 plus switches to upgrade.

In USCC's experience, the above upgrade procedure is not unique to Nortel but is relatively standard throughout the industry.